



MACHINERY

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The Industry That Sets the Production Pace

Automotive manufacturers have for years set the pace in the development and application of advanced production methods. No proposed manufacturing processes have ever been too radical or too expensive, provided the final results were economy and quality. Some of the latest methods utilized in this industry are described in articles presented in the special section of this annual Automotive Production number.

Ford's New Methods of Machining Axle Housings

An Unusual, High-Production Set-Up for Manufacturing Light-Weight Rear-Axle Housings from Welded Steel Tubing. The Work Passes Automatically through Tube-Reducing, Welding, and Machining Operations on This Completely Mechanized Production Line

By CHARLES H. WICK

THREE hundred rear-axle housings are produced per hour at the Mound Road plant of the Ford Motor Co. on a completely automatic production line which incorporates special machines of unique design. Tube-reducing, welding, and machining operations are performed on the work as it is transferred mechanically from operation to operation and from machine to machine, the completed axle housings being turned out at the end of the line with practically no manual handling.

The rear-axle housings for Ford automobiles were previously made from tubular housings to which were welded forged flanges and a cast drum. One of the features of the Ford 1949 models is a light-weight "banjo type" axle housing that is made from a pair of tubes only. This design reduces the weight of the housing approximately 8 pounds and decreases the cost of manufacture. A flange is formed on one end of each tube, and half of the banjo is formed on the opposite end. Two of the tubes are then joined

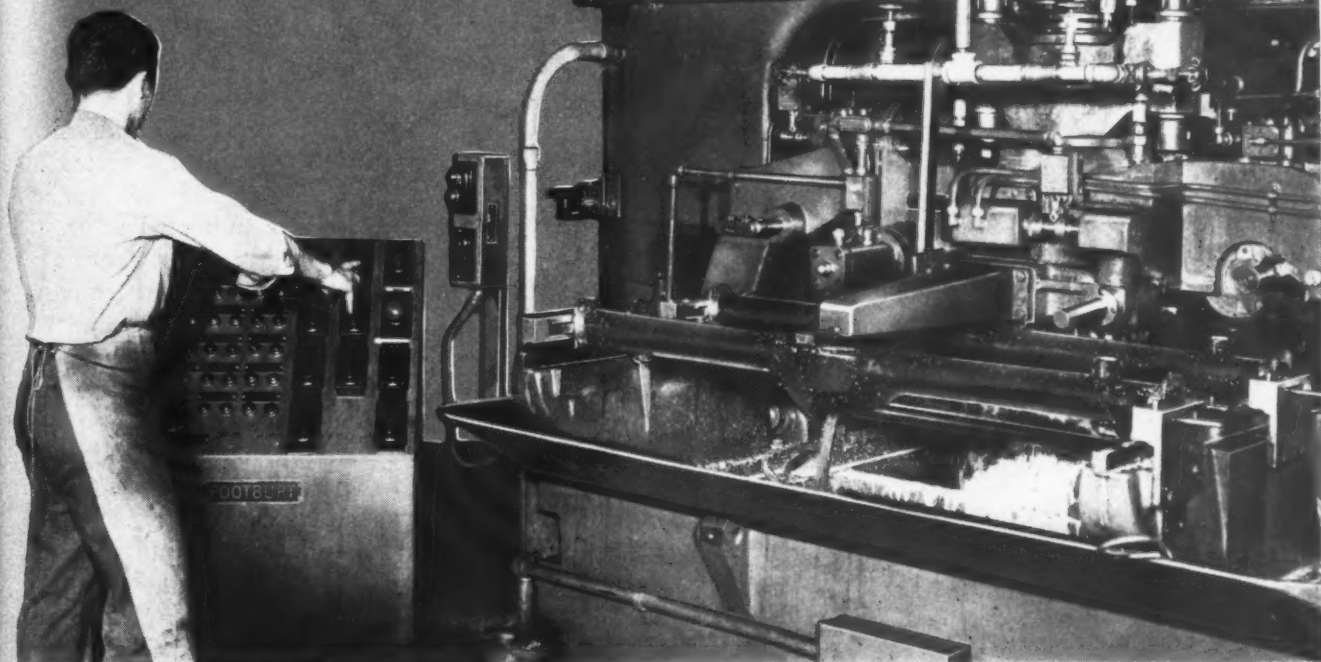
by welding, thus producing an integral axle housing.

Welded SAE 1010 steel tubing, 30 1/2 inches long by 4 1/2 inches outside diameter, is employed, as shown at A in Fig. 1. Two tubes, each weighing approximately 15 1/4 pounds, are required for each rear-axle housing. The wall thickness of the purchased tubing is held to a tolerance of 0.005 inch. Welding flash formed in the bore of the tube during its manufacture must not exceed a height of 0.015 inch.

The tubes are placed in a hopper which automatically loads them on an overhead chain conveyor. This conveyor passes through a washing machine, where the tubes are sprayed with a boiling alkaline cleaning solution to remove any oil or grease. Still mounted on the conveyor, the tubes are dipped in a tank to coat them with a borax-base drawing compound. The compound is heated to a temperature of 180 degrees F., so as to thin it and facilitate application.

After being conveyed through an infra-red

Forming and



tunnel, maintained at a temperature of 210 degrees F. to dry the compound, the tubes are automatically transferred to the hopper of a hydraulically operated tube-reducing machine. This special double-end, horizontal-acting press makes two reductions in the diameter of the tube, as shown at B in Fig. 1.

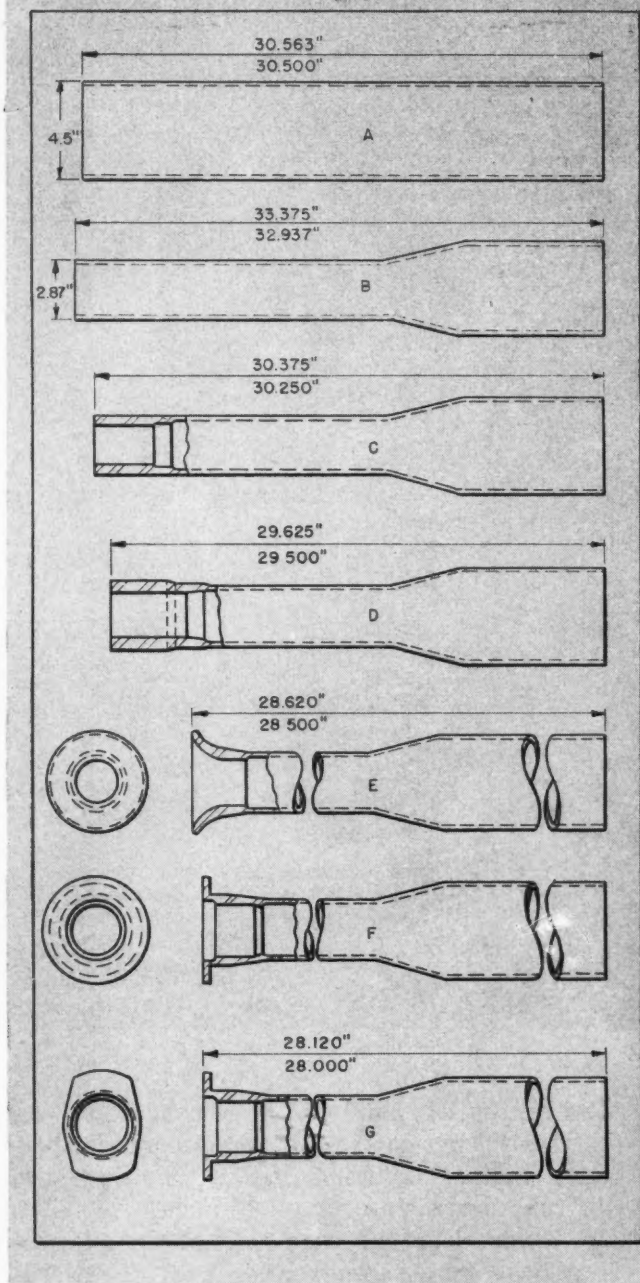
Each tube is lifted automatically from the hopper to the working position, as shown in Fig. 2. Here the right-hand end of the tube is gripped between a pair of side-acting hydraulically actuated jaws. A die containing tube-reducing inserts and straightening bushings is mounted on each side of the horizontally reciprocating ram, shown at the left of the work. As the ram advances toward the right the die is forced over the tube, reducing its diameter for approximately three-fourths of the length.

After the first reduction has been completed, the ram and dies are retracted, the jaws are automatically opened, and the partially formed tube falls to the platform seen in the foreground of the illustration. The platform, tilting downward, deposits the tube in a conveyor which carries it to the opposite end of the machine. Here the tube is again lifted and gripped by a pair of

jaws on the left-hand end of the machine. As the ram travels to the left, the second die performs another reduction in the tube diameter, this time decreasing it to 2.87 inches. Thus, a tube is completed for each cycle of the machine (consisting of a ram stroke in each direction), and a production of 300 tubes per hour is attained.

At the completion of the second reduction, the tubes fall onto a floor type conveyor which carries them to a propane-fired furnace. They are pulled through the 30-foot long furnace by a conveyor which causes the tubes to roll along horizontal rails, so that they will be evenly heated. Only the reduced diameter end of the tubes is subjected to the heat. At the unloading end of the furnace, seen at the right in Fig. 4, they have been heated to a temperature of 2300 degrees F.

Here the tubes roll down a chute into the automatic tong feeding attachment of the 6-inch capacity upsetting machine shown in the illustration. Because of the relatively thin wall of the tube and the short time that the heat can be retained, only two of the four upsetting operations required are performed in this machine.



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Fig. 1. Successive Steps in Forming the Flanged Hub End of Half an Axle Housing from the Welded Steel Tubing Shown at A

After the tube has been fed between split gripper dies, a punch enters the bore of the tube and upsets the small-diameter end to the shape shown at C in Fig. 1. The tube is then automatically lowered to a second set of gripper dies, where the hot tube is formed to the contour indicated at D.

The upset tubes are removed from a pit under the machine by another conveyor which carries them through a second furnace, where the ends are reheated to 2300 degrees F. An upsetting machine similar to the one previously used is then employed for the third forming and the final forming, as well as the trimming of the formed hub end, as seen at E, F, and G, Fig. 1.

Conveyors again automatically remove the tubes from a pit below the upsetting machine and carry them through a water quench tank where they are cooled to permit handling. After removal from the conveyor by hand, the unformed "banjo" ends of the tubes are flattened on a 150-ton press to the shape shown at A in Fig. 3. The same end of the tube is then notched, as shown at B, on a 150-ton knee type press. A horn on the ram of the press enters the flattened end of the tube for notching both sides.

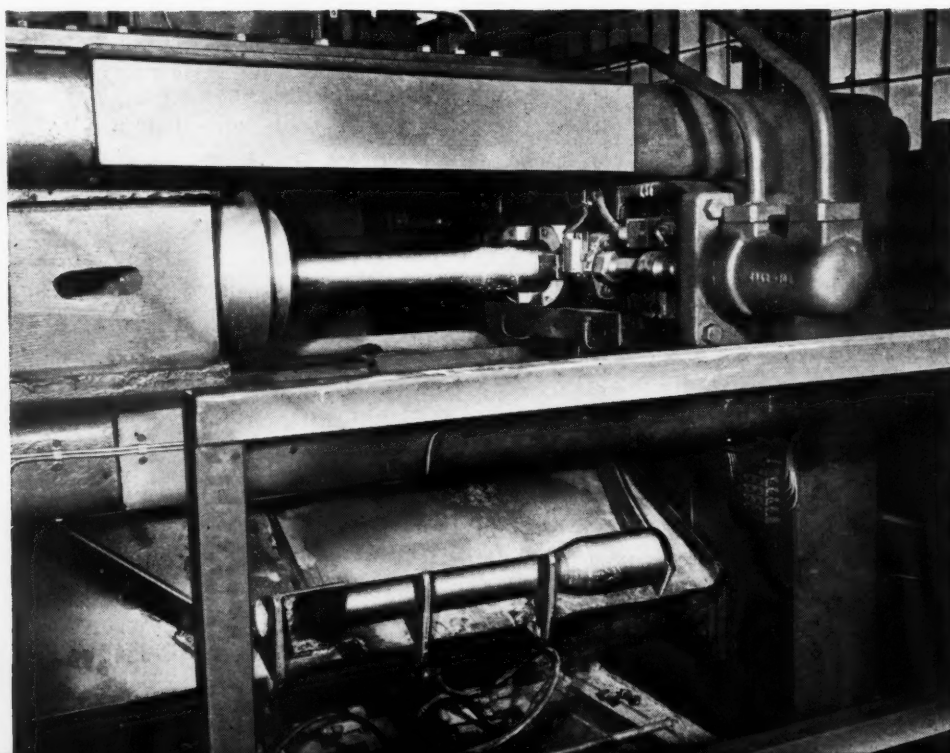


Fig. 2. One Side of a Double-end, Horizontal-acting Press in which Tube Diameter is Decreased from 4.5 to 2.87 Inches in Two Reductions

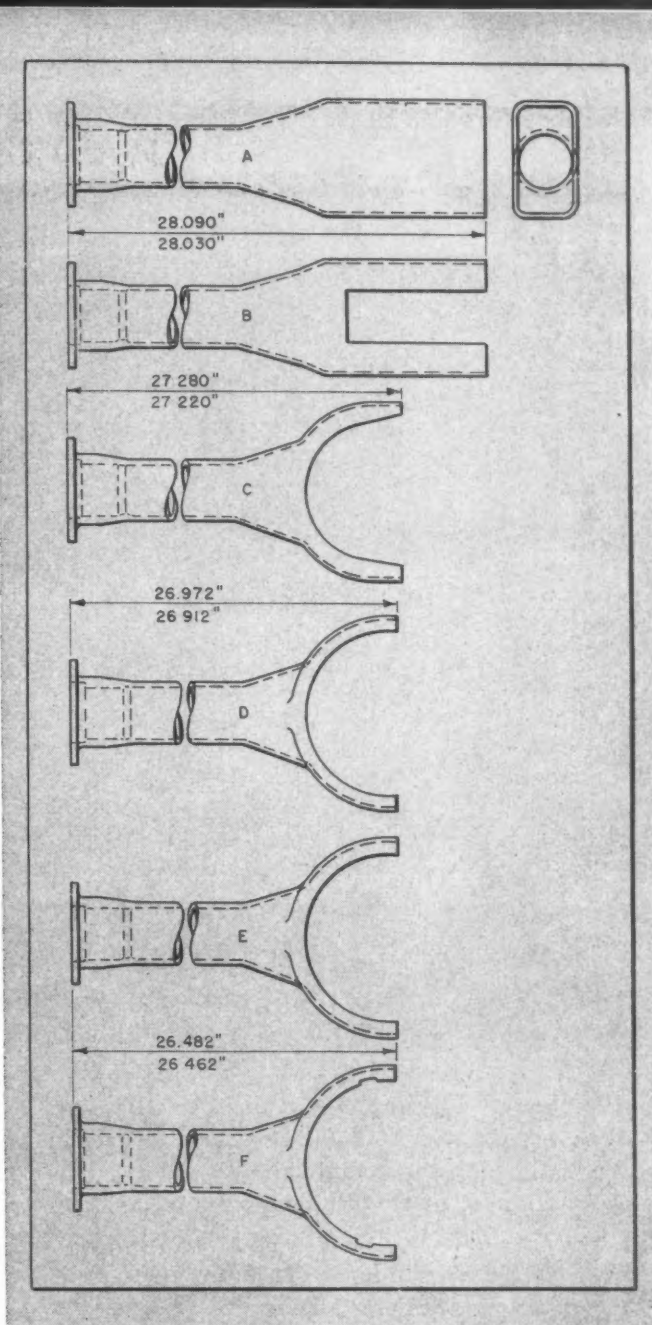
XLE HOUSINGS

Fig. 3. A Semicircular Yoke, which Forms Half of the "Banjo," is Produced on Right-hand End of Tube by Steps Shown

Close tolerances are required in manufacturing the notching die used for this operation. Dimensions of the corners and sides of the notch must be closely maintained to prevent pinching and tearing of the metal when it is subsequently formed into channel-shaped yokes that are welded together to form a complete "banjo" differential housing.

The next step in the process is to relieve the stresses set up in the reducing, flattening, and notching operations. For this purpose, the tubes are conveyed through a 30-foot long furnace at the rate of 600 per hour. The furnace is fired with propane gas and maintained at a temperature of 1400 degrees F. The monorail conveyor that carries the tubes through the furnace continues through an automatic alkaline washing machine, where scale, grease, and dirt are removed from the tubes, and then into a dip tank in which another coat of drawing compound is applied preparatory

Fig. 4. (Below) The Reduced-diameter Hub Ends of the Tubes are Forged in This Upsetting Machine after being Heated to 2300 Degrees F. in a Gas-fired Furnace



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Fig. 5. First Forming Operation Performed on the "Banjo" End of the Rear-axle Housing Tube. A Borax-base Drawing Compound is Employed to Facilitate the Severe Forming

to the "banjo"-forming operations. An infra-red tunnel, maintained at 210 degrees F., is again employed to dry the compound.

An automatic machine unloads the tubes from the monorail conveyor and loads them on an unusual automatic turret, which carries the parts from press to press for five "banjo"-forming

operations. The five presses employed for these operations are arranged in a semicircle around the turret. Successive operations in forming half of the rear-axle housing "banjo" on each tube are indicated in Fig. 3. The first forming operation is shown at C; the restrike or final forming operation at D; the trimming of the

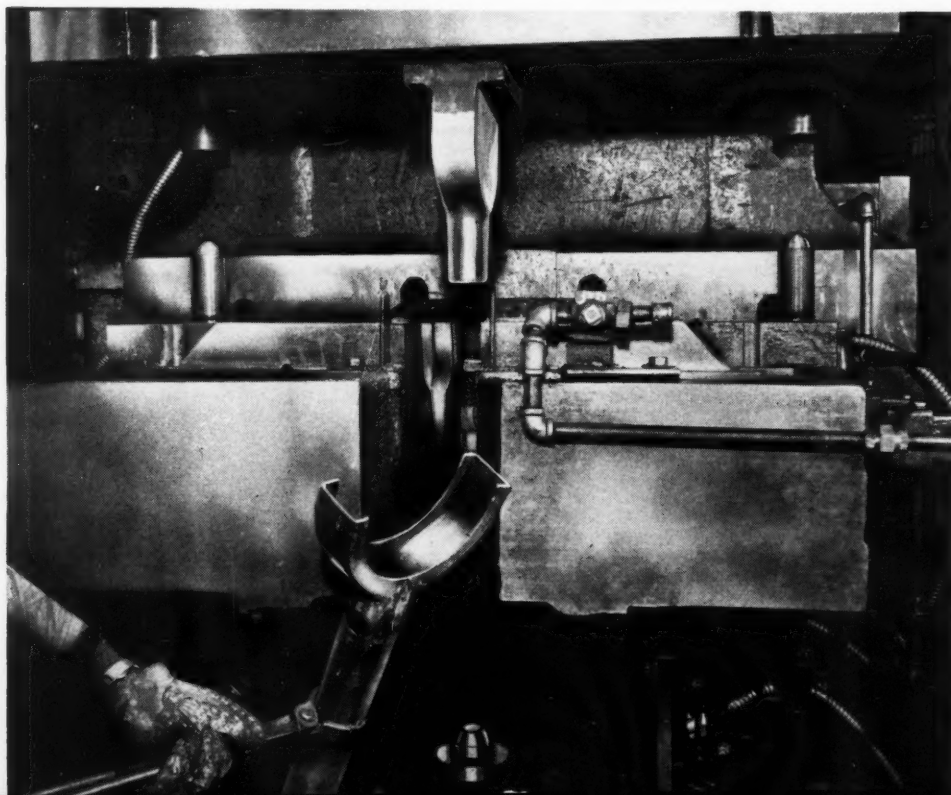


Fig. 6. Restrike or Final Forming Operation on the "Banjo." This Photograph and Fig. 5 were Taken before Installation of a Turret for Automatically Loading the Presses

Fig. 7. The "Banjo" Ends of Two Formed Tubes are Joined by Butt-welding to Produce an Integral, Light-weight Rear-axle Housing at a Production Rate of 120 per Hour



"banjo" ends at *E*; and the trimming of the "banjo" radius at *F*. Close-up views of the first and final forming operations, taken before the automatic handling turret was installed, are shown in Figs. 5 and 6.

After removing the drawing compound by means of a hot alkaline wash, two formed tubes are welded together to produce an integral rear-axle housing. The two channel-shaped yokes are butt-welded in a 600-KVA machine, as seen in Fig. 7. At the completion of the welding, the tubular assembly is automatically lifted from the machine by a pair of bellcranks, which are pivoted about a horizontal shaft by means of vertical pneumatic cylinders shown at both ends of the machine. The axle housing rolls down a chute to the trimming machine. About half a minute (floor-to-floor time) is required for the welding operation.

Flash resulting from the butt-welding operation is removed by two form tools, mounted on oscillating rams of the trimming machine, Fig. 8. One tool, mounted on the ram shown in the center, trims the flash from the bore of the

"banjo." A second form tool, mounted above the first, trims the periphery and sides of the "banjo." It is necessary to turn the axle housing through an angle of 180 degrees to trim the opposite weld.

Two spring seats are automatically arc-welded to the tubular portion of the axle housing on a 600-ampere welding machine. Four arcs, one on each side of both spring seats, are struck simultaneously, the axle housing being turned about its horizontal axis during the welding. Four welds are completed in approximately twelve seconds.

A flange plate, 5/32 inch thick, is then tacked to one face of the "banjo" differential housing by four spot-welds on a 250-ampere projection welding machine. This serves to hold the plate in position during a subsequent operation in which the entire periphery of the plate is arc-welded to one face of the "banjo" while a 1/16-inch thick sheet-metal stamping is similarly welded to the other face, as shown in Fig. 10.

The assembly, consisting of axle housing, spot-welded flange plate, and cover stamping, is

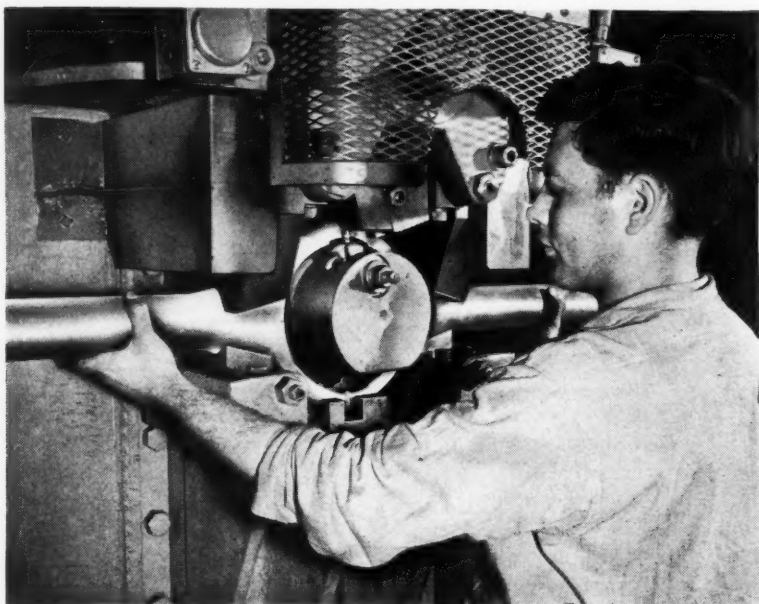


Fig. 8. Flash Resulting from the Butt-welding Operation is Removed from Both Inside and Outside the "Banjo" by Two Form Tools Mounted on a Trimming Press

placed between two holding heads on the welding machine. One head is shown swung away from the welded cover in the illustration. As the assembly is rotated through an angle of 360 degrees about the axis of the "banjo," two submerged-arc welding heads—one of which is shown at the upper right—are actuated to complete the continuous welds. Flux falling from an overhead hopper covers the electrodes and enters a screen-covered hopper below the work. The 1/8-inch diameter welding rods are automatically fed, as required, and the operation is completed in fifteen seconds.

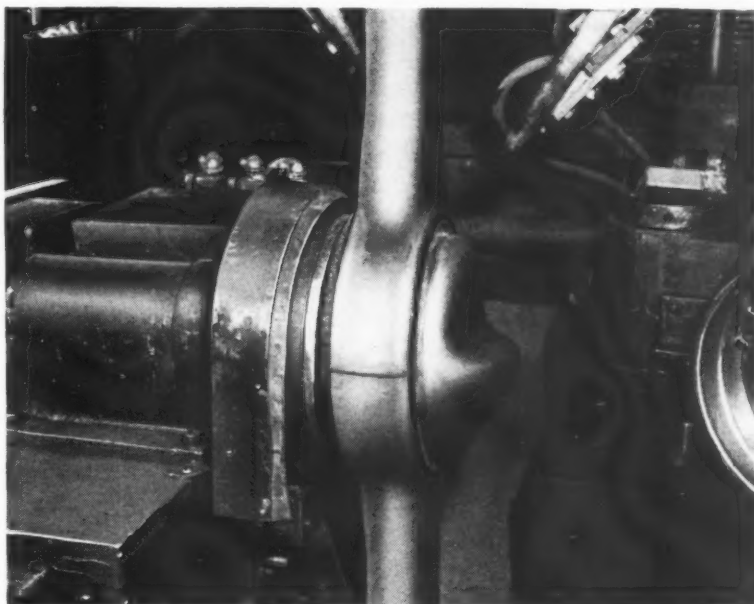
A breather hole in the tubular portion of the axle housing and a drain-plug hole in the "banjo" are drilled and tapped in the special nine-station machine shown in Fig. 9. The axle housings are automatically transferred from station to station after being manually loaded at the first station. At the second station, Fig. 11, a propane-fired gas torch *A*, automatically ignited by means of a spark plug, is employed to heat that portion of the tube where the breather hole *B* is to be drilled and tapped. After heating, an air-actuated punch *C* is driven through the wall of the tube to extrude the metal



Fig. 9. Nine-station Drilling and Tapping Machine for Producing a Breather Hole in the Tubular Portion of the Axle Housing and a Drain-plug Hole in the "Banjo"

AND MACHINING AXLE HOUSINGS

Fig. 10. A Flange Plate and Sheet-metal Stamping are Welded to the Faces of the "Banjo" in an Automatic Machine. Plate is Previously Tacked to Housing by Spot-welding



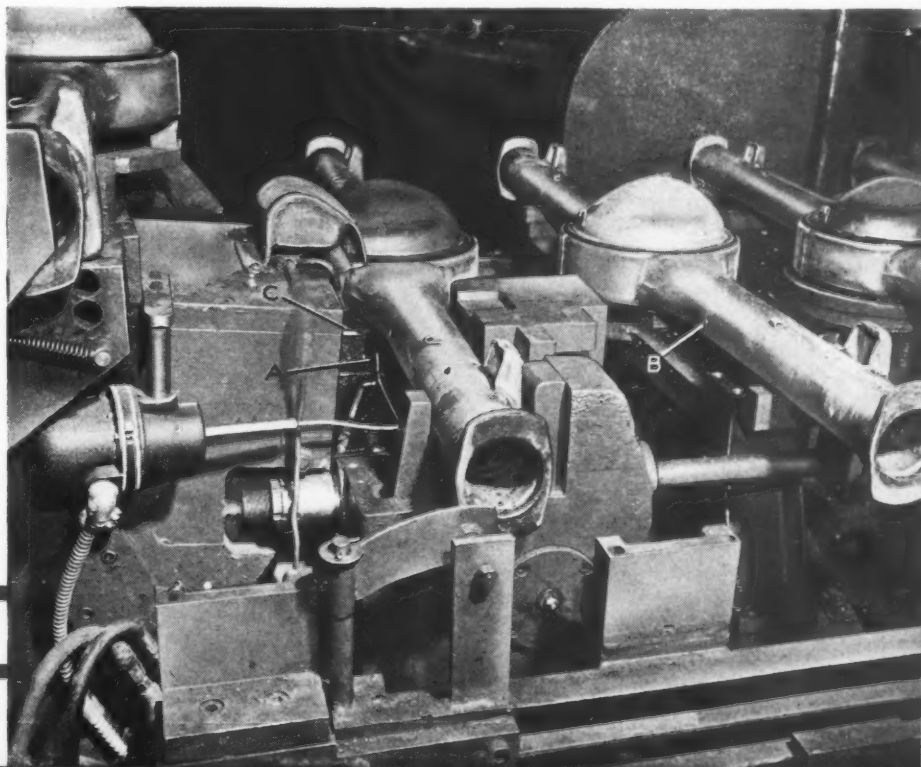
and thicken the wall at this point, so that a longer thread can be cut in the tube.

The third station is idle, allowing the part to cool. At the fourth station, an 11/32-inch diameter hole is drilled through the stamped cover and one side of the "banjo" for the drain-plug hole. The fifth, sixth, and seventh stations are idle. At the eighth station, the extruded breather hole is threaded with a 7/16-inch 20-thread tap and the drain-plug hole is threaded with a 1/8-inch 27-thread American Standard straight pipe tap, after which the axle housings are automatically unloaded at the ninth station and placed

on a conveyor. All openings in the axle housings are then plugged and the housings are tested for leaks by water pressure. Any leaks detected are sealed by arc-welding.

While still on the conveyor, the housings are painted black in an automatic spray booth and dried in an infra-red oven. After inspection, the housings are loaded manually, two at a time, at the first station of the special transfer type machine shown in Fig. 12. Each pair of housings is automatically lifted by an independent transfer mechanism, advanced from station to station, located with hydraulic equalizing clamps,

Fig. 11. Air-operated Punch C is Driven through the Wall of the Tube to Produce the Breather Hole B after the Tube has been Heated by the Gas-torch A



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and machined. Accurate location is accomplished by work-holding fixtures that are an integral part of the individual machines at each station. Every station, except the loading one, consists of a double-end machine tool, and each machine is equipped with a two-spindle head at both ends.

At the second station, both ends of the two axle housings are rough-bored and chamfered by four boring cutters. The machine at the third station is equipped with rotating tools for turning the outside diameter of the end flanges and the bolt clearance diameters of the housings adjacent to these flanges. Wheel bearing seats are semi finish-bored at the fourth station. The machine employed at this station is a duplicate of that used at the second, but the boring cutters are rotated at a higher cutting speed.

The fifth and sixth stations are employed for rough- and finish-facing the flanges on both ends of the rear-axle housings. Single-point, carbide-

tipped tools are mounted on the hydraulically fed, rotating cross-slides of these machines. Two tools are mounted on each rotating tool-head at the fifth station for straddle-facing the end flanges. A single tool is mounted on each head at the sixth station to finish-face the outside surfaces of the flanges.

Upon the completion of this series of operations, the rear-axle housings are transferred to the loading station of the special transfer type machine shown in the heading illustration and in Fig. 13. At the second and third stations of this machine, the flange plates previously welded to the "banjo" faces of the housings are rough-, semi-finish-, and finish-faced by tools mounted on a vertical-spindle head.

The fourth and fifth stations are idle, while at the sixth station, four holes in each flange and ten holes in the "banjo" face are drilled and reamed. Reaming of these holes was formerly done at the eighth station, but by using sub-

Fig. 12. Both Hub Ends of the Axle Housing are Bored, Turned and Faced at the Rate of 150 per Hour on This Six-station Transfer Type Machine. Ten Housings are Machined Simultaneously



AND MACHINING AXLE HOUSINGS

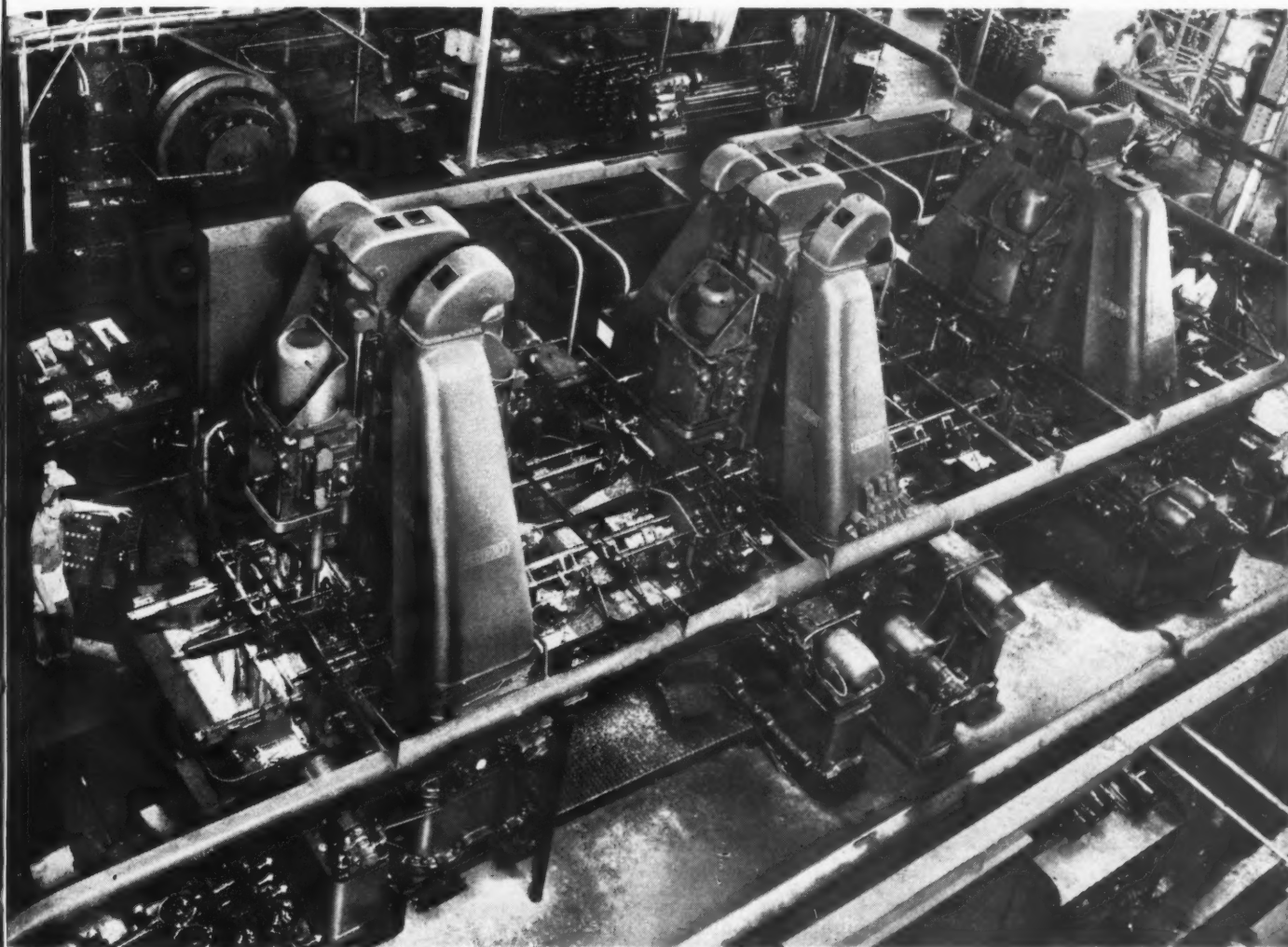
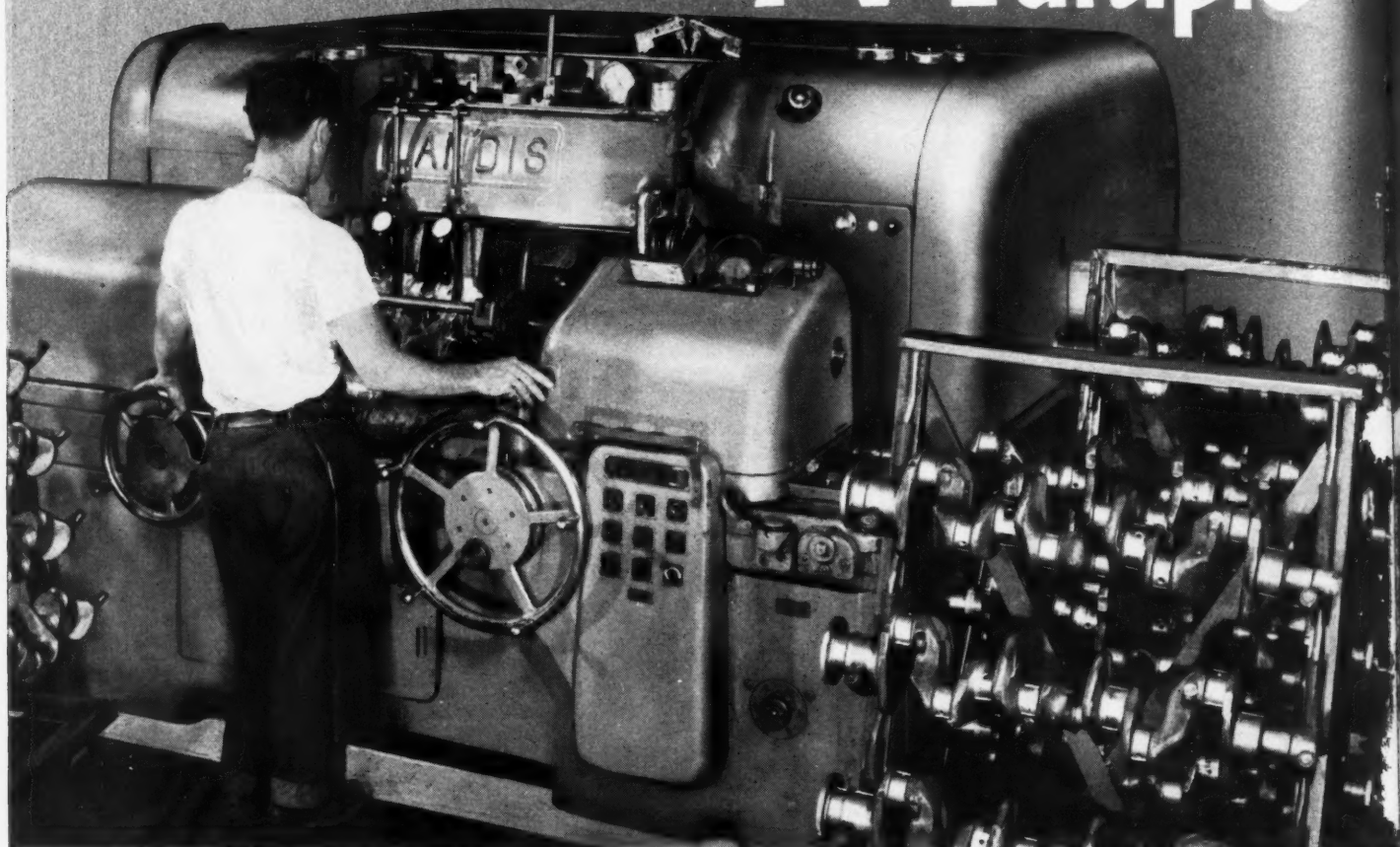


Fig. 13. Transfer Type Machine for Facing the "Banjo"; Drilling and Reaming Holes in the End Flanges and "Banjo" Face; and Finish-boring the Oil-seal and Bearing Seats in the Axle Housings

land combination drilling and reaming tools, both operations can be performed at one station. Horizontal-acting, multiple drill heads produce the holes in the end flanges. Ten sub-land drill-reamers are mounted in a multiple head on a vertical spindle. The final operation performed on this machine consists of finish-boring the oil-seal and bearing seats in both ends of the axle housings. The tolerance on these diameters is 0.0007 inch, total indicator reading.

Completed housings are automatically unloaded from the transfer machine and loaded on a monorail type conveyor which carries them through an automatic washer. Here the parts are sprayed with a hot alkaline wash maintained at a temperature of 180 to 200 degrees F., rinsed with water heated to 160 degrees F., and blown off with steam. Finally, after drying in air at room temperature, the axle housings are loaded on pallets for shipment to assembly plants.

M Multiple



CRANKSHAFTS for Studebaker "Champion" automobile engines are being manufactured at the rate of 450 per eight-hour shift by means of the latest mass-production techniques and equipment. One of the outstanding developments is the use of multiple-wheel grinding machines, which results in reducing machining time and equipment requirements to a minimum. This application of multiple-wheel grinding, as well as other time-saving methods and equipment used in this plant, are described in the following.

Forged from SAE 1046 steel, the crankshafts are heat-treated to a Brinell hardness of from 241 to 260. Locating and driving flats are milled on the cheeks of the crankshafts in the Cincinnati Hydromatic milling machine shown in Fig. 1. Cuts $2\frac{3}{4}$ inches long by $\frac{9}{16}$ inch deep by $\frac{1}{4}$ inch wide are made by six carbide-tipped, negative-rake milling cutters. The tools are rotated at a cutting speed of 523 surface feet per

minute and fed downward hydraulically at the rate of 15 inches per minute and along the work at 25 inches per minute. The actual cutting time is thirty-four seconds, and forty-nine crankshafts are completed per hour.

All main bearings of the crankshaft are rough-turned, the main-bearing cheeks are finish-faced, and flanged counterweights and shoulders are straddle-faced in one operation on LeBlond automatic crankshaft lathes. The speed of the crankshaft is automatically varied from 17 to 115 R.P.M. during the cutting cycle to produce surface speeds ranging from 45 to 60 feet per minute. The feed of the sixteen high-speed steel tools is progressively increased from 0.36 inch to 1.5 inches per minute by means of cams as the tools approach the center of the shaft. From $\frac{1}{8}$ to $\frac{1}{2}$ inch of stock is removed from the forged main-bearing diameters. The production is seventeen shafts per hour.

All the main bearings are finish-turned in one

Wheel Grinding Speeds-up Crankshaft Production

Main Bearings of Six-Cylinder Automotive Crankshafts are being Finished Three Times Faster than Previously by the Use of Multiple-Wheel Grinding Machines. Bearing Diameters are Maintained to a Tolerance of 0.0005 Inch without Rough-Grinding

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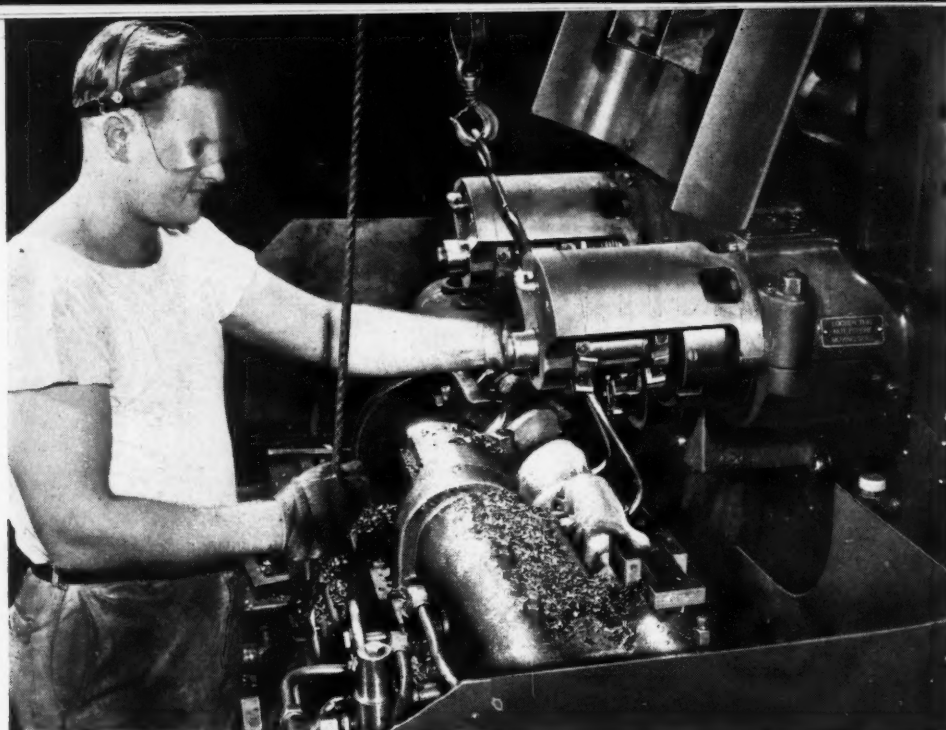
set-up on LeBlond four-station, continuous-production crankshaft lathes, such as the one shown in Fig. 2. In the same set-up, the outside diameters of the gear fit, pulley fit, oil-seal, oil-ring, bolt shoulder, and flange are finish-turned; both sides of the flange are faced; and the front bearing is turned to length. In this operation, the main bearings are turned to within ± 0.003 inch of the desired size, which eliminates the rough-grinding operation previously required.

After loading at the first station, the crankshafts are automatically indexed to the remaining stations by a revolving drum mechanism. Only 0.06 minute is required for indexing, and a crankshaft is completed in a 1 1/4-minute cycle, thus giving a production of thirty-two per hour. A total of approximately 0.054 inch of stock is removed from each rough-turned main bearing, 0.008 inch being removed at the fourth

station by shaving tools. Two work speeds are provided—a slow one of 33 1/2 R.P.M. and a fast one of 117 R.P.M. At the slow spindle speed, the fifteen high-speed steel tool bits and six shaving tools are fed at the rate of 3/16 inch per minute, and at the fast speed, at 1 1/2 inches per minute.

Pin bearing sides of the crankshaft cheeks are finish-faced from the peripheries of the counterweights to the shoulders of the pin bearings on LeBlond two-spindle, automatic crankshaft lathes. The crankshafts are held at both ends in hydraulically operated pot type chucks. Steadyrests are provided at the right and left and in the center of each crankshaft to minimize misalignment.

High-speed steel tool bits are mounted in the twelve tool-blocks provided for both upper and lower spindles. The speed of crankshaft rota-



CRANKSHAFT

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Fig. 1. Locating and Driving Flats are Milled on the Cheeks of the Crankshafts at the Rate of Forty-nine per Hour in This Set-up

tion is progressively increased, in thirty-two steps, from 29 to 88 R.P.M. as the diameter being cut decreases. This provides a cutting speed varying from 39 to 60 surface feet per minute. The tools are fed at the rate of 1 to 2 1/2 inches per minute, and approximately 3 3/4 inches of stock is removed from the face of each cheek. Thirty-one crankshafts are completed per hour per machine.

The pin bearings are rough-turned on similar two-spindle automatic crankshaft lathes at the rate of thirty-four shafts per hour. Twenty-four tools—twelve horizontal and twelve vertical—cut each of the two crankshafts on one machine. The work is revolved at 67 R.P.M., and the tools are fed at 3.7 inches per minute, giving a chip load of 0.0055 inch.

Deep angular oil-holes are drilled in the crankshafts on a series of two-spindle Leland-Gifford hydraulic drilling machines in the manner shown in Fig. 3. One man operates three machines, thus drilling six oil-holes in each crankshaft at the rate of 17 1/2 shafts per hour. Special high-speed steel crankshaft drills, 1/4 inch in diameter by 9 inches long, are rotated at 660 R.P.M. and fed hydraulically at the rate of 0.003 inch per revolution.

Hydraulic step-feed attachments on the drilling machines automatically withdraw the tools from the holes after they have drilled 1/4 inch deep to allow chips to escape. The drills are then advanced again, and this cycle is repeated until the holes are drilled to a depth of 4 3/4 inches. Oil-holes and the centers in the ends of

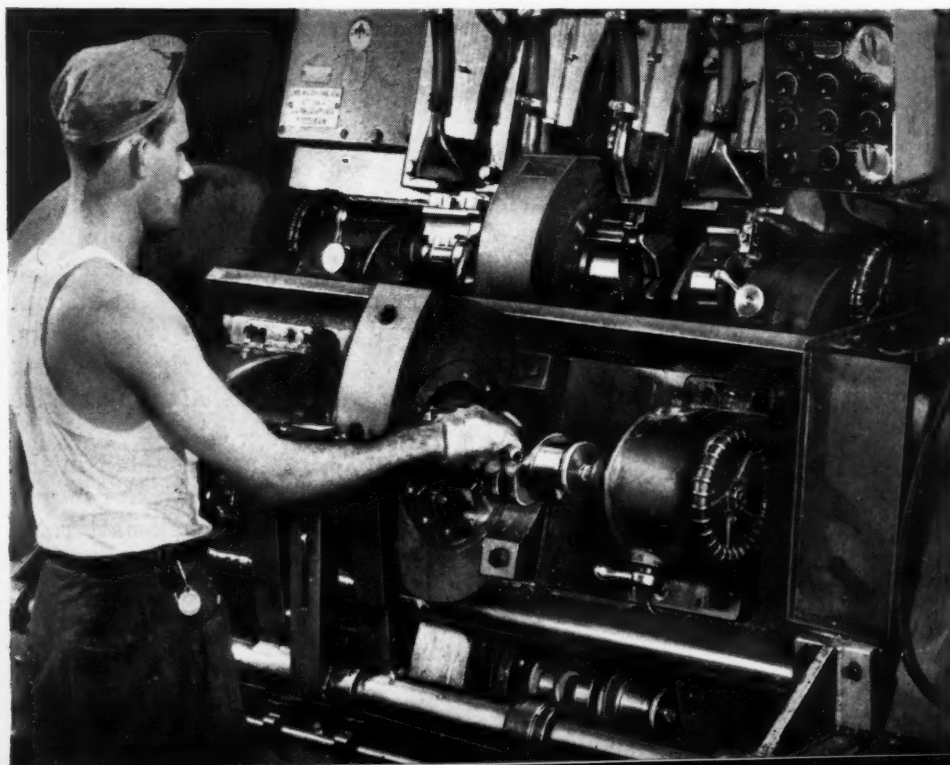


Fig. 2. All the Main Bearings are Finish-turned on a Four-station Crankshaft Lathe. The Limits Maintained in This Operation Eliminate the Need for Rough-Grinding

Fig. 3. Deep Angular Oil-holes are Drilled in the Crankshafts by the Use of a Series of Two-spindle Hydraulic Drilling Machines



the crankshafts are countersunk to remove burrs. The crankshafts are then straightened, if required, to a tolerance of 0.003 inch on the over-all length.

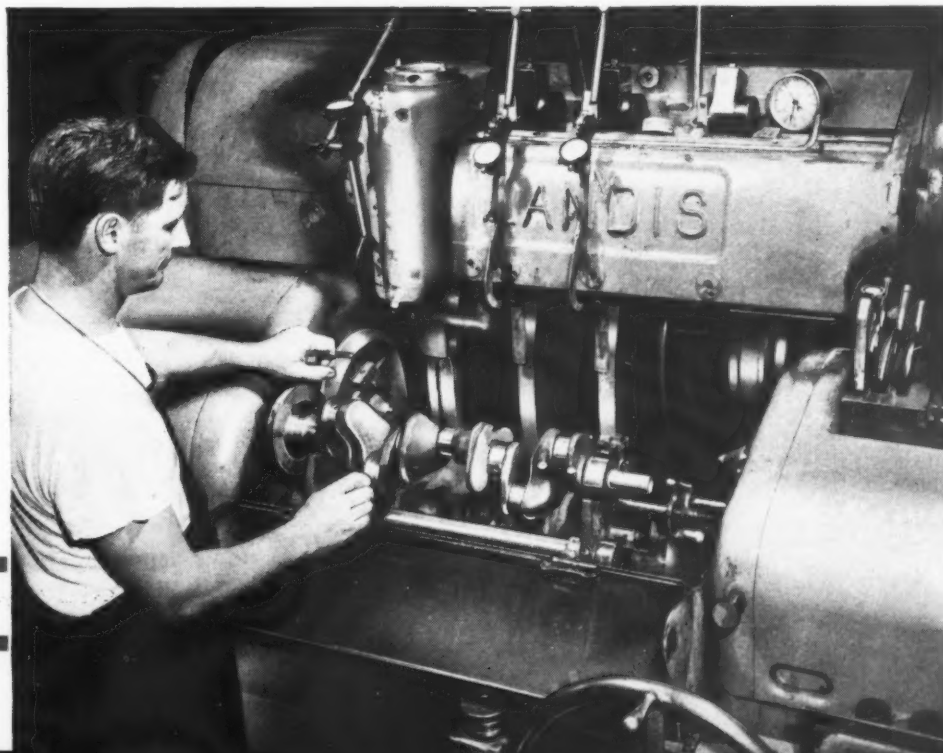
The two center main bearings, rear main bearing, and oil-seal diameter are all finish-ground simultaneously, at the rate of 25 1/2 crankshafts per hour, on Landis multiple-wheel cylindrical grinding machines, such as the one shown in the heading illustration. Previous methods of performing these operations on single-wheel grinding machines required three machines and three operators to attain the same production rate. Bearing size is maintained within 0.0005 inch tolerance.

Three abrasive wheels—two 40.810 inches in diameter by 1.390 inches wide, and the other

41.010 inches in diameter by 2 5/8 inches wide—are mounted on the single wheel-spindle of this machine. The larger wheel is recessed to permit grinding the rear main bearing and the oil-seal diameter with the same wheel, thus producing the effect of four separate wheels on one machine. It is important that the wheels be obtained in matched sets.

Aluminum-oxide abrasive having a medium grain size of from 54 to 60, a relatively hard grade of O or P, a medium structure of 6, and a vitrified bond is employed for all grinding wheels. By releasing hinged clamping blocks, the entire wheel-spindle and spindle-bearing assembly can be lifted out of the machine. The 20-inch wheel bores permit the wheels and their retaining rings to be slipped over the bearing

Fig. 4. In the Multiple-wheel Grinding Operation, the Crankshaft is Held in a Tilting Cradle Type Fixture, which Swings the Work into the Grinding Position, as Shown in Fig. 5



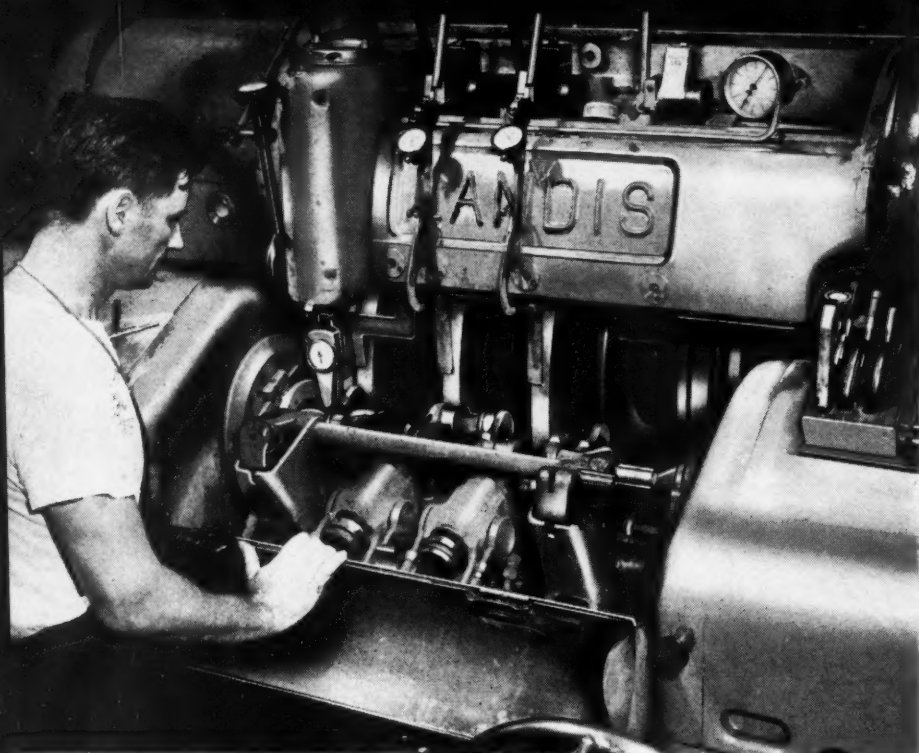


Fig. 5. When the Crankshaft has been Swung into the Grinding Position, it is Located Endwise by Means of Dial Indicator Gage Shown at Left Center

housing without the necessity of disturbing the bearing assembly.

In operation, the crankshafts are rotated at 110 R.P.M. (or 70 feet per minute surface speed), and full-size grinding wheels are revolved at 600 R.P.M. As the wheels wear, their speed is progressively increased to maintain about the same surface speed of 6500 feet per minute. Wheels are changed when they have worn down to 32 inches in diameter, approximately 100,000 crankshafts being ground per set of wheels.

From 0.017 to 0.025 inch of stock is removed from each bearing diameter at the rate of 0.0005 inch per revolution. Wheel feeds are hydraulically operated, a rapid feed being provided to advance the wheels quickly to the grinding posi-

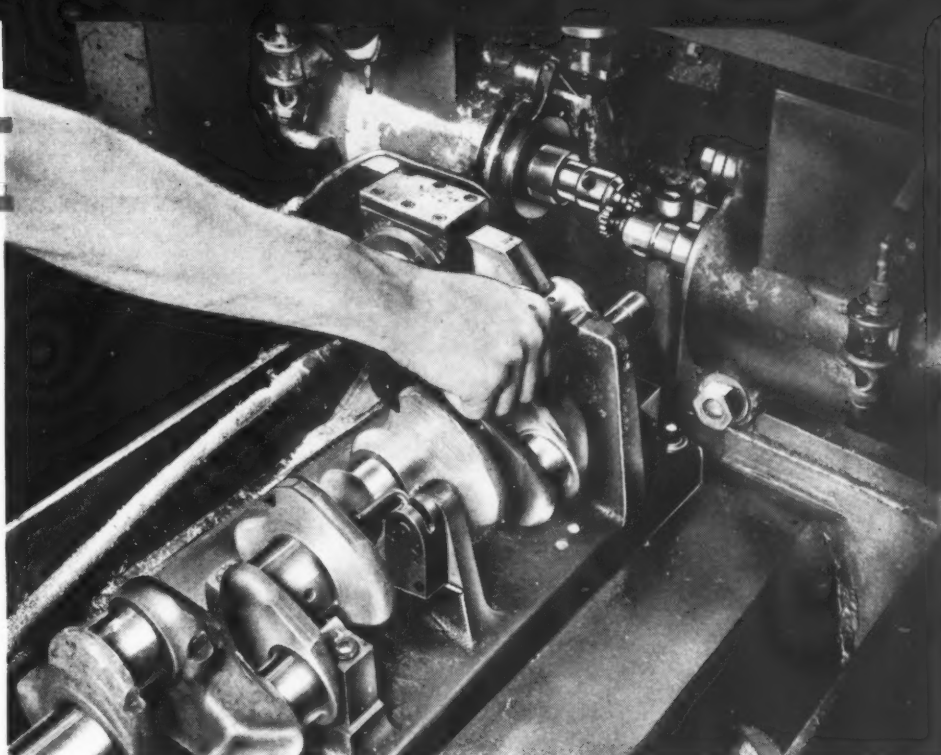
tion. After grinding about twenty-five crankshafts, it is necessary to dress the wheels. This is accomplished by a table type diamond dresser. The table of the dresser is reciprocated past the wheels hydraulically, a rapid traverse being provided between wheels. Two passes are made per dressing, removing 0.001 inch of abrasive on the first pass and approximately 0.0005 inch on the second.

The crankshafts are held in a tilting cradle type fixture, Fig. 4, which swings the shaft into the grinding position between hydraulically actuated headstock and tailstock centers, Fig. 5. Since the longitudinal spacing between bearings is also critical, the crankshaft is located endwise by means of the dial indicator gage shown at the left center. Hydraulically operated rests



Fig. 6. Two Formed Grinding Wheels are Employed to Finish the Front Main Bearing, a Thrust Wall, and the Pulley and Gear Seat Diameters of the Crankshaft

Fig. 7. Two Keyways are Milled Simultaneously in the Front End of the Crankshaft at the Rate of Sixty Shafts per Hour on a Special Milling Machine



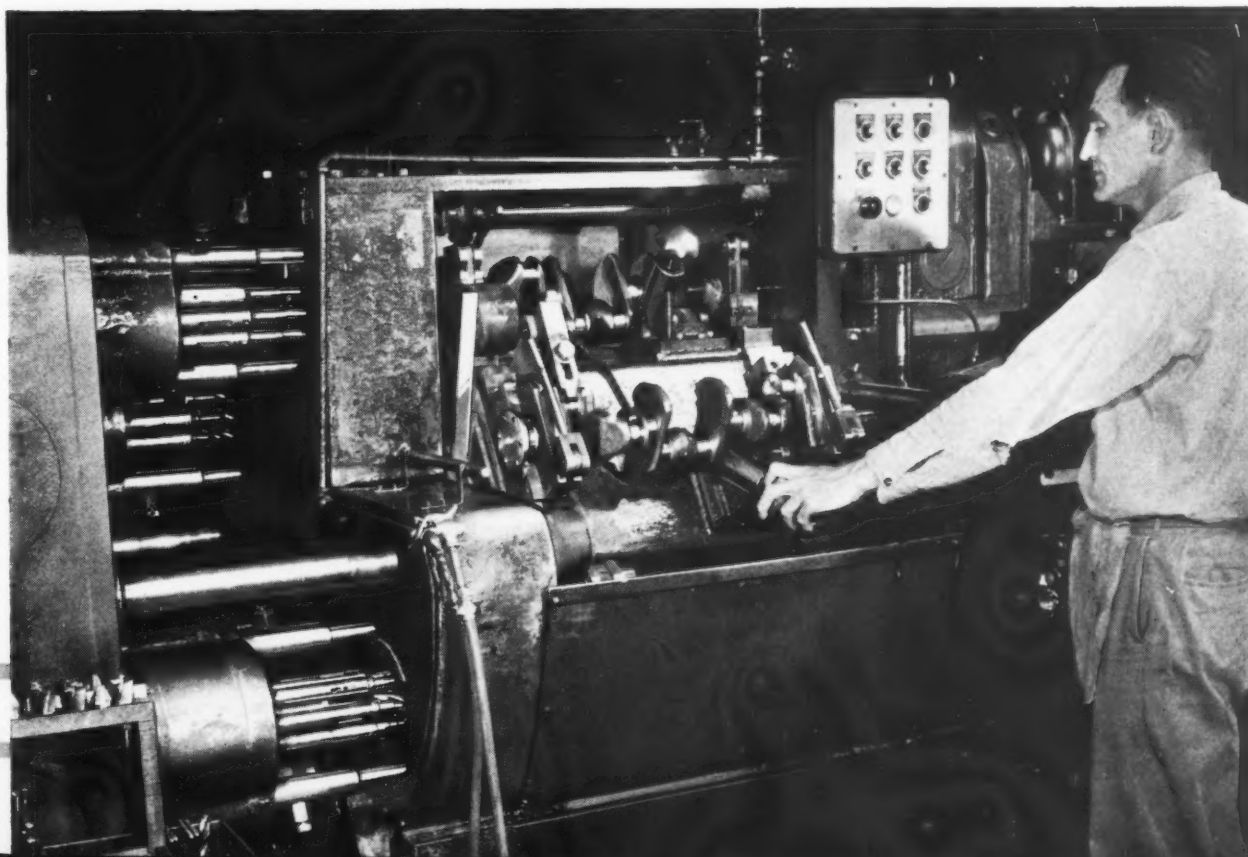
with carbide-tipped crankshaft-support shoes automatically move into position at the end of the rapid wheel-feed stroke.

Arnold hydraulic dial indicating gages are used to automatically size the surfaces being ground. Although the allowable tolerance on the main-bearing diameters is 0.0005 inch, the size in most cases is held within 0.0003 inch to facilitate subsequent lapping. Each operator is provided with a set of master ring gages to calibrate his micrometers. The multiple-wheel

grinding machines are set on special foundations to minimize the transmission of vibration from surrounding areas. The foundations include a built-in, 500-gallon coolant tank and circulating systems.

The front main bearing, the thrust wall for this bearing, and the pulley and gear seat diameters are finish-ground simultaneously on the Landis two-wheel cylindrical grinding machine shown in Fig. 6. The wheel-head of the machine is set at an angle of 30 degrees, and two formed

Fig. 8. A Double-end, Six-station Drilling Machine of Special Design Drills, Countersinks, Reams, Counterbores, and Taps the Ends of the Crankshafts



CRANKSHAFT

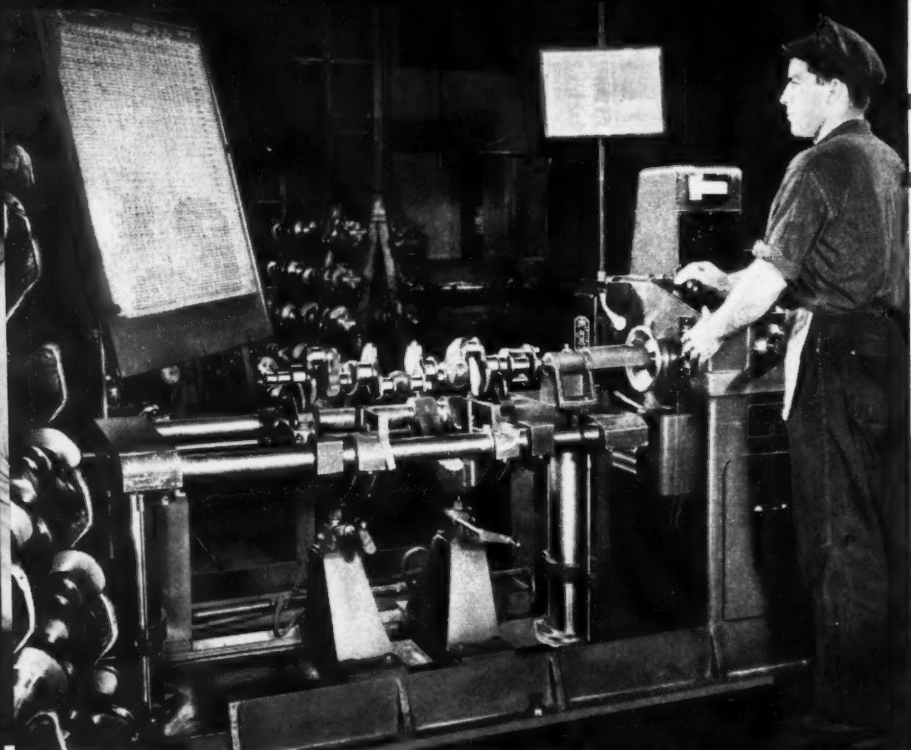


Fig. 9. Dynamic Unbalance of Crankshaft is Determined by Means of This Testing Machine. Amount and Location of Unbalance are Marked on the Shaft for Subsequent Drilling

Fig. 10. Main and Pin Bearings are Lapped on an Automatic Machine, which Removes 0.0003 to 0.0004 Inch of Stock from Each Diameter



wheels, 30 inches in diameter, are employed to grind the four surfaces simultaneously. The abrasive wheels are of the same type as used on the multiple-wheel grinder previously described. Surface speeds, feeds, and amount of stock removed are also the same, except that only 0.007 inch is removed from the thrust wall. A production of 30 1/2 crankshafts per hour per machine is obtained.

It is necessary to dress the wheels after grinding from forty to fifty crankshafts. A special table type dressing fixture holding three diamonds is employed for this operation. Two passes are made per dressing, removing 0.001 inch of abrasive from the wheels in one pass and 0.0005 inch in the second. A total of about 65,000 crankshafts can be ground with each set of wheels.

MANUFACTURING METHODS AT THE STUDEBAKER PLANT

The six pin bearings of each crankshaft are ground on a series of Landis single-wheel crankpin grinding machines. The surface speed of the grinding wheel varies from 6000 to 7000 surface feet per minute. If the wheel glazes rapidly or burns the work, it is slowed down; if the wheel breaks down too rapidly, it is speeded up. Sparking at the edges of the wheel is carefully observed to insure that an equal amount of stock is removed from each side of the pin bearings.

After grinding the outside diameter and face of the crankshaft flange on similar single-wheel machines, two keyways are milled simultaneously on the opposite end of the shaft by the special Cincinnati keyway milling machine seen in Fig. 7. One keyway is 0.187 inch wide by 0.2251 inch deep, and the other is 0.2495 inch wide by 0.3225 inch deep. The first keyway is for a No. 9 Woodruff key that holds a pulley to the shaft, and the other for a No. 15 key that secures a gear to the shaft. Both keyways are held in alignment with the No. 1 crankpin. The cutters are rotated at 40 surface feet per minute and fed at the rate of 1 inch per minute. The production is sixty crankshafts per hour.

Both flange and front ends of the crankshaft are machined at the rate of forty per hour on the special Greenlee double-end, six-station drilling machine shown in Fig. 8. At the first station, six bolt-holes are drilled through the flange, and the center holes in both the flange and front ends are drilled. At subsequent stations, the bolt-holes are countersunk and reamed, the flange-end center is countersunk and counter-

bored, and the front-end center is countersunk and tapped. The various tools are rotated at 50 surface feet per minute, and are fed at the rate of 2 inches per minute.

After burring and straightening, the crankshafts are dynamically balanced on Tinius Olsen testing machines, Fig. 9. The amount of dynamic unbalance in each end of the crankshaft can be determined by observing the indicating gage shown at the right of the machine, which is calibrated to read in ounce-inches. From figures listed on the blueprint seen at the left, the operator marks with chalk positions on the crankshaft showing the size and depth of holes to be drilled for balancing the crankshaft within 0.5 ounce-inch. Holes $\frac{5}{8}$ or $\frac{3}{4}$ inch in diameter are then drilled to the required depth, care being exercised not to break through into the oil-holes. Not more than three holes are drilled in each shaft, and the holes are not made over 1 $\frac{1}{2}$ inches deep.

After the balancing operation, the four main bearings and six pin bearings of each crankshaft are lapped on the Schraner machine shown in Fig. 10. From 0.0003 to 0.0004 inch of stock is removed from each diameter, employing rolls of 280 grit emery cloth. The lapping time is automatically controlled. The crank is oscillated axially about 0.090 inch during lapping to obtain a surface finish of from 4 to 6 micro-inches r.m.s. Final inspection of the crankshafts includes the use of Pratt & Whitney Electrolimit gages for measuring bearing diameters, as shown in Fig. 11.

Fig. 11. Bearing Diameters are Inspected by Means of Electrolimit Gages. Tolerance on Main Bearings is Held to 0.0005 Inch



Welding Hudson's Body-and-Frame

Latest Type Automatic, Multiple-Transformer Resistance Welding Machines and Portable Welders Suspended above Unique "Merry-Go-Round" Conveyors are Employed in Making Approximately 5300 Spot-Welds per Car

By CHARLES H. WICK

ONE of the primary considerations in designing the new Hudson automobile was to provide a low center of gravity, in order to obtain safety, beauty, and comfort. This was accomplished by combining both body and frame into a single all-welded rigid unit. A steel box-section frame is built into the body and extends outside the rear wheels.

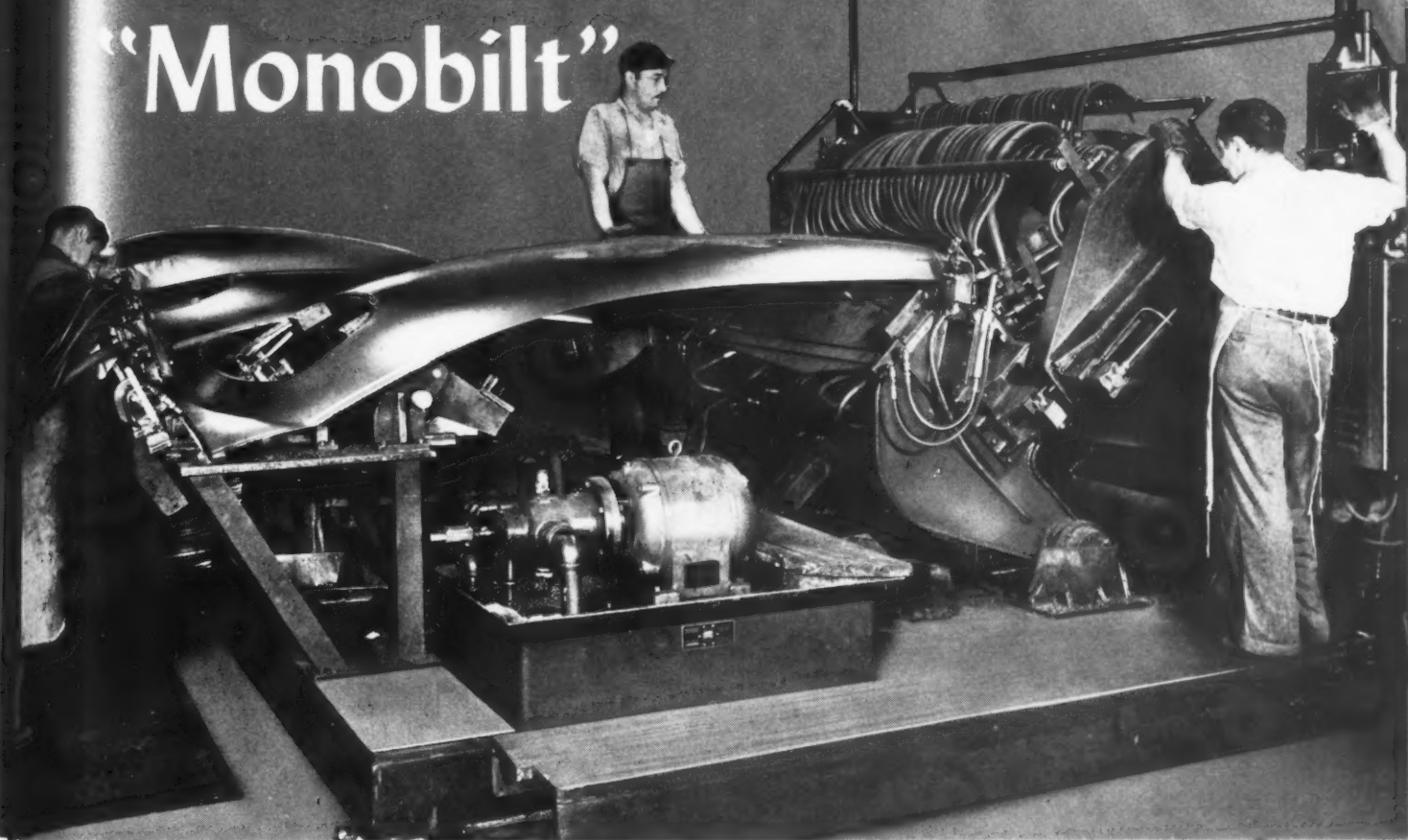
The new design entailed extensive plant and equipment changes, as well as the development of new techniques and machines for welding. Assembly-line methods, in which the work is brought to the welder, have been used wherever practicable. Approximately 5300 spot-welds are required to complete each unit.

Resistance welding is employed in the majority of cases. Electronic controls insure that a minimum amount of heat is generated and high

production is attained. For certain applications, Heliarc spot-welding is employed. The advantage of this method—sometimes called "poke" spot-welding—is that copper back-up and filler rod are not required, which permits its use where blind rivets or large yoke guns would otherwise be needed.

Two halves of the wheel-housing assembly, made from 18-gage (0.049 inch thick) sheet-metal stampings, are joined on an automatic multiple spot-welding machine built by the Expert Welding Machine Co. This operation is illustrated in Fig. 1. Eighty-four spot-welds, spaced 3/4 inch apart, are made on each wheel-housing assembly at production rates up to 100 assemblies per hour. Since it is impossible to mount the electrodes as close as 3/4 inch apart, the welding operation is performed in three

"Monobilt"



cycles. Each cycle produces twenty-eight welds, spaced $2\frac{1}{4}$ inches apart, the electrode assembly being indexed $\frac{3}{4}$ inch between each cycle.

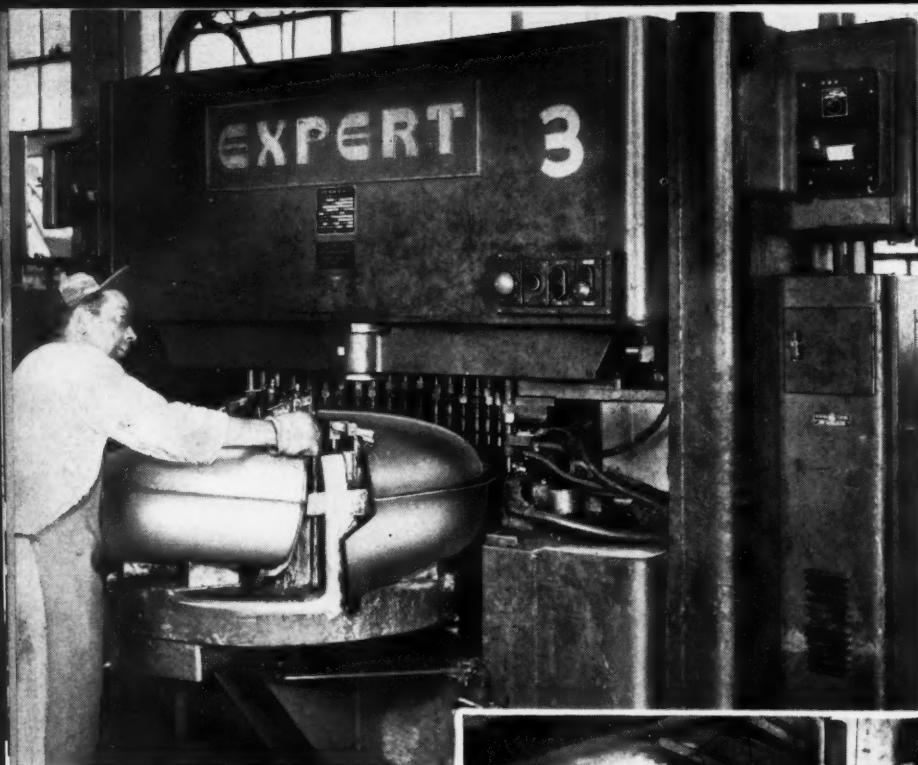
Two fixtures are mounted on the rotary table of the welding machine, one fixture being used for unloading and reloading while the parts mounted in the other fixture are being welded. Since the contour of the weld is not a radius, the rotary table is mounted on a hydraulically operated reciprocating slide, which permits it to be moved away from the welding station each time that it is rotated.

Shuttle type multiple spot-welding machines, made by the same company, are employed for welding the frame and under-body sub-assemblies. Three such machines are employed for the following operations: Sub-assembly of the rear section; joining the rear-compartment floor-panel assembly to the rear-frame sub-assembly; and sub-assembly of the forward section of the floor pan. All three machines are of similar design, with the exception of the fixtures and welding heads. The production is eighty sub-assemblies per hour.

The parts to be joined in the sub-assembly are

loaded on a fixture at one end of the shuttle table, as shown in Fig. 2. Simultaneously, parts mounted on a second fixture at the opposite end of the table are being welded. When the welds are completed, the welding head is automatically raised and the table shifts to the position shown in Fig. 4. While the welding cycle is being repeated at this end of the machine, a completed sub-assembly is removed from the fixture at the opposite end, and this fixture is reloaded with other parts.

The welding heads of these machines, containing the welding guns, hydraulic manifolds, transformers, and ultra-speed distributor units, are mounted on a hydraulically operated vertical slide having four posts that are guided in bearings fixed to upright columns. Ninety-eight spot-welds are made on each sub-assembly in two cycles. All electrodes are lowered into the working position simultaneously, but pressure is applied to only half of them at one time. Multiple spot-welds can be made automatically and at high speeds by means of the ultra-speed distributor. Each sub-assembly is completed in forty-five seconds, floor-to-floor time.



WELDING HUDSON'S

Fig. 1. Two Sheet-metal Stampings are Joined by Eighty-four Spot-welds to Form a Wheel-housing Assembly. Up to 100 Assemblies are Produced per Hour

Fig. 2. Shuttle Type Multiple Spot-welding Machines are Employed for Welding Frame and Underbody Sub-assemblies at the Rate of Eighty per Hour

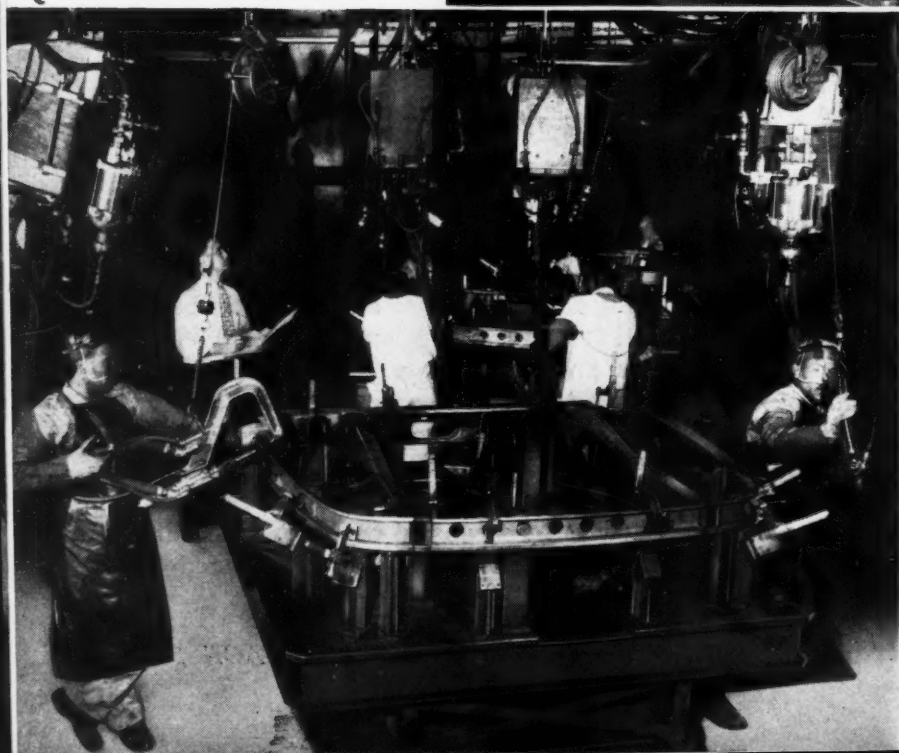


Fig. 3. A Rear-frame Merry-go-round on which Stampings and Welded Sub-assemblies, Held on Eight Portable Fixtures, are Joined by Means of Portable Spot-welders Suspended from Above

"MONOBILT" BODY-AND-FRAME

Fig. 4. After Mounting Parts on the Fixture Shown at the Left-hand End of the Table in Fig. 2, the Table is Shifted to the Right to Bring the Fixture below the Welding Head, as Illustrated

Six merry-go-round type floor conveyors—two each for the frame, structure, and side panels—are employed to carry the stampings and welded sub-assemblies to the portable welding machine operators. The frame merry-go-rounds contain eight portable fixtures, while the structure and side-panel conveyors have eleven fixtures. The fixtures were built up on surface plates, using masters to locate the clamps and thus insure a high degree of accuracy. The frame conveyors travel at the rate of 16 1/2 feet per minute, the structure conveyors at 13 1/3 feet per minute, and the side-panel fixtures at 15 feet per minute.

The starting point of the body assembly is the rear-frame merry-go-round shown in Fig. 3. Standard toggle clamps are employed to hold the stampings securely in the fixtures during welding. At this point, the rear frame is held upside down to facilitate spot-welding. Outer frame member and inner box-section members are both made from 16-gage (0.065 inch thick) and 13-gage (0.095 inch thick) sheet-metal stampings.

Portable pneumatic and hydraulic resistance welders (made by the Martin Electric Co. and the Taylor-Winfield Corporation) and 75-KVA transformers are suspended from overhead monorails to allow the operators to move along with the fixture. Transformers, connecting cables, gun arms, and electrodes are water-cooled. Weld timers, which automatically control the welding cycle, are provided on panels adjacent to the merry-go-rounds. All transformers, including those on the welding machines, operate from 440-volt, 60-cycle, three-phase alternating current.

Each roof panel is stamped from a single sheet of cold-rolled steel, 70 inches wide by 130 inches long by 20 gage (0.036 inch thick). Window reinforcement frames are welded to the

Fig. 5. Close-up View of the Back-up Die Assembly (Left) and Welding Head (Right) Used on the Window-reinforcement Frame Welder Shown in the Heading Illustration



WELDING HUDSON'S "MONOBILT" BODY-AND-FRAME



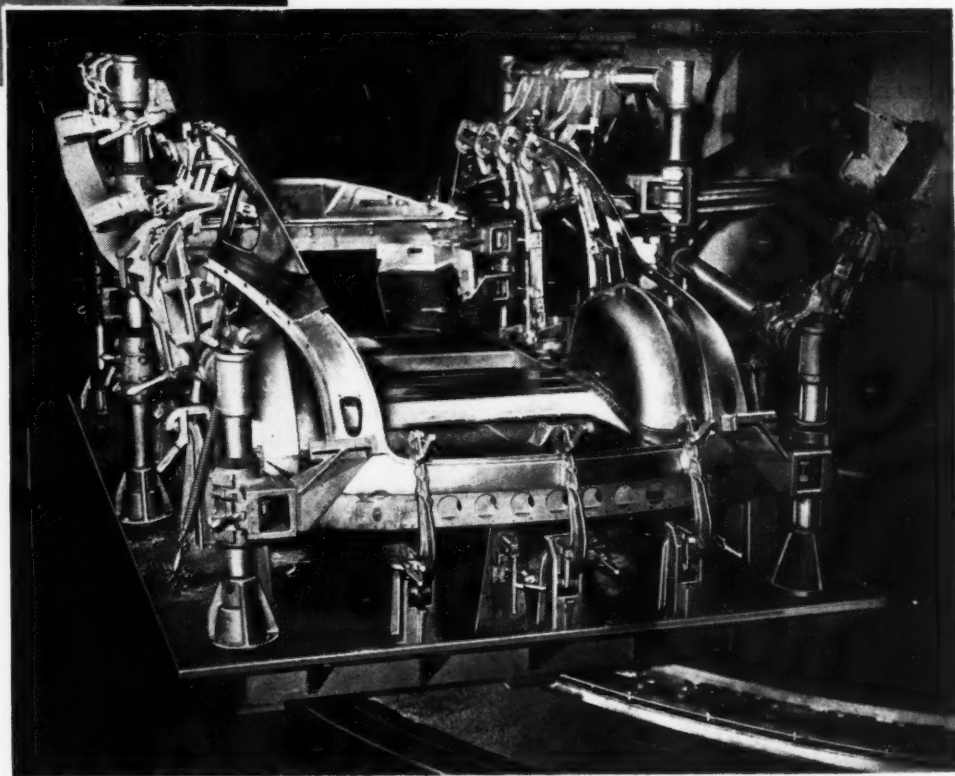
Fig. 6. Reinforcement Frames are Welded to the Rear Window Openings of the Roof Panels at the Rate of Eighty per Hour

windshield openings in these stampings at the rate of 90 per hour, on the machine shown in the heading illustration. Openings in the roof panel and reinforcement frames are accurately located by small steel blocks, mounted on the back-up die seen at the left in Fig. 5.

The back-up die assembly is pivoted, so that it can be swung out of the window frame after welding. The welding head is also pivoted to permit swinging it in and out of the working position. A pressure plate on the welding head clamps the parts during welding to prevent distortion. All electrodes contact the work simultaneously with uniform pressure, passing through openings in the pressure plate. Power demand is held to a minimum by employing ultra-speed distributors. Sixty spot-welds are made in ten seconds by supplying power, in rapid succession, to groups of four electrodes.

While the machine is going through its auto-

Fig. 7. Conveyorized Body-structure Assembly Fixture Used in Welding Together the Roof, Side Panels, Cowl, and Completed Under-body to Form the Integral "Monobilt" Body-and-frame



WELDING HUDSON'S "MONOBILT" BODY-AND-FRAME

Fig. 8. Sixty-four Spot-welds are Made on Car Doors at the Rate of 125 Doors per Hour by the Use of This Machine

matic cycle, an upper deck reinforcement is joined to the roof assembly by means of a portable gun at the opposite end of the machine. Reinforcement frames are welded to the rear window openings of the roof panels on the machine shown in Fig. 6.

Body-structure assembly fixtures, such as the one shown in Fig. 7, are self-contained conveyorized units, built on accurately machined surface plates. Vertical and horizontal tubes of the fixtures are ground to close tolerances to insure accurate alignment of the various sub-assemblies. Of the two merry-go-rounds used for this assembly, one handles four-door bodies and the other coupes and broughams (Tudors).

In this operation, the roof, side panels, cowl, and completed under-body are loaded into the fixture and welded to form the integral "Monobilt" body-and-frame. Right- and left-hand side-body assemblies are held in position during

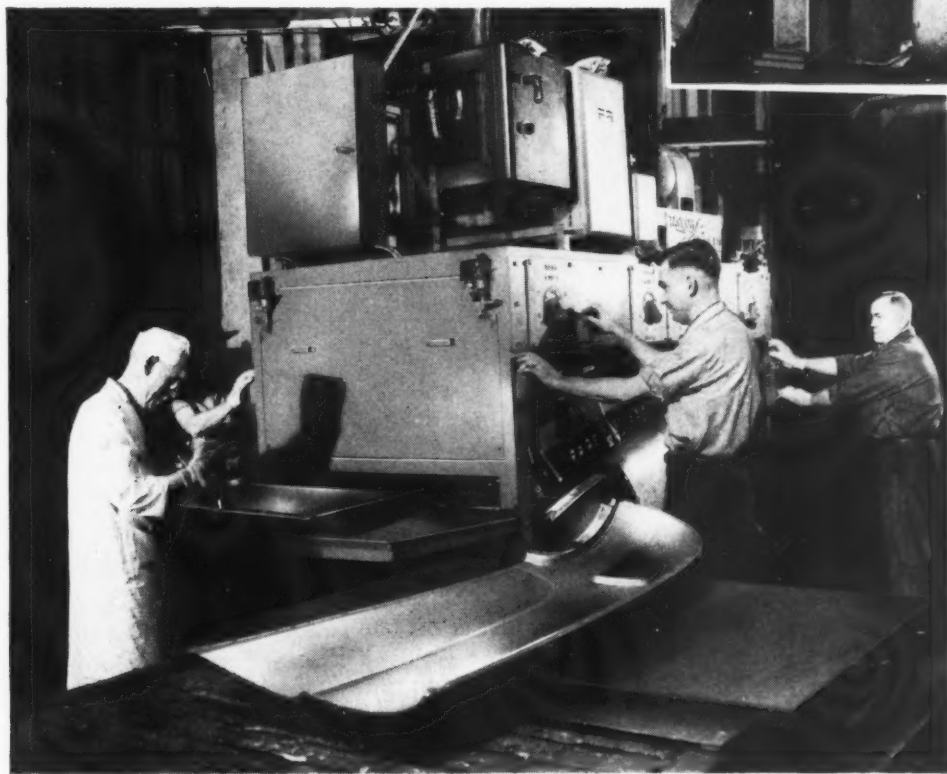
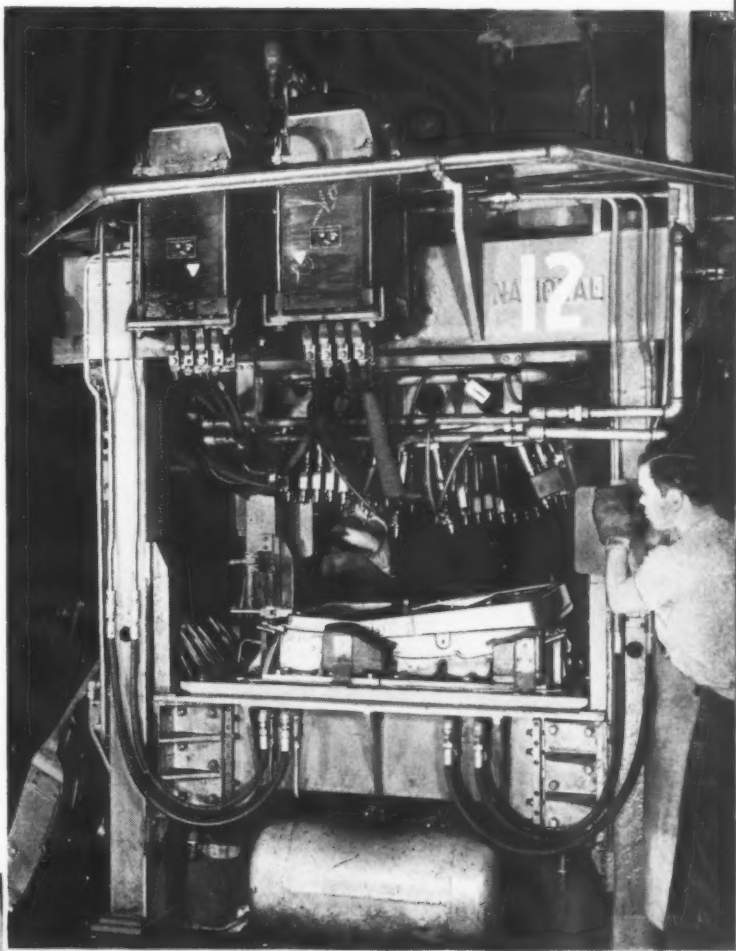


Fig. 9. Reinforcements are Joined to Both Right- and Left-hand Rear Fenders on the Special Double-side Resistance Welding Machine Here Shown at the Rate of 250 Fenders per Hour

WELDING HUDSON'S "MONOBILT" BODY-AND-FRAME

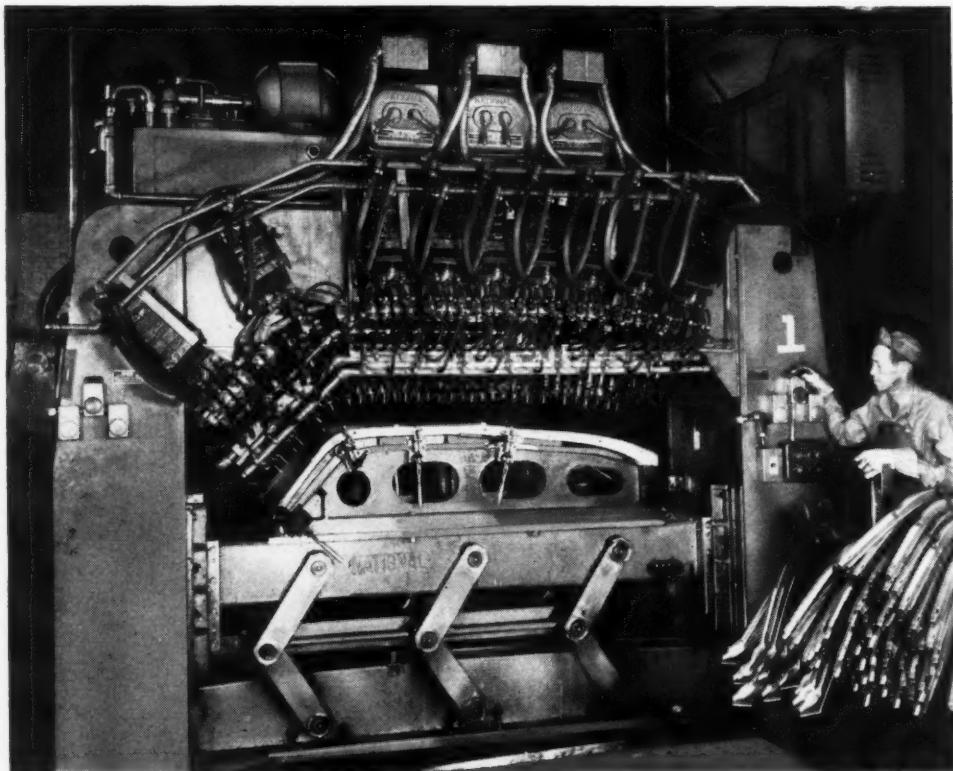


Fig. 10. Special Current-carrying Welding Guns are Employed on This Resistance Welder to Permit Making 144 Spot-welds in the Limited Space Available

welding by quick-acting, gate type toggle clamps which can be swung about the horizontal tubes on this new type fixture.

At successive stations around the oval track of the merry-go-round, the roof and front-end assemblies are lowered into the fixtures, clamped, and welded. Each completed body-and-frame is hoisted from the fixture to the floor above for assembly of doors and rear fenders, finishing, and painting.

One of four National resistance welders employed to automatically weld the car doors can be seen in Fig. 8. By adding small sections to the die (or removing them) and adjusting the hydraulic pressure actuating the guns, one machine can be used to weld the front doors of sedans, coupes, or other body models.

Each machine is equipped with eight 50-KVA transformers to provide power for as many as sixty-four guns at one time. The guns are actuated in three groups to minimize peak-load power requirements. When all welds are made in this way, a production of 125 doors per hour is obtained. The fixture is raised hydraulically to the welding position, where pressure is ap-

plied to the guns. All welds are produced in "series," thereby eliminating transformer connections to the lower platen.

Reinforcements are joined to both right- and left-hand rear fenders on the special Taylor-Winfield "Hydro-Speed" welding machine shown in Fig. 9. Right-hand fenders are welded along one side of the machine, and left-hand fenders on the opposite side. Each side of the machine is equipped with thirty-two hydraulically actuated welding guns and four 50-KVA transformers. Eight of the guns and two of the transformers can be made inactive when shorter sedan fenders are to be welded.

Air-operated clamps are provided to hold the fenders to the correct body contour, over the lower electrodes of the guns, while they are being welded. Individual spot-welds are made rapidly in series, each transformer supplying power for making two welds at a time. All welds are completed on one fender before the guns are actuated for welding the fender on the opposite side of the machine. A production of 250 fenders per hour is attained, with two operators working on each side of the machine.

WELDING HUDSON'S "MONOBILT" BODY-AND-FRAME

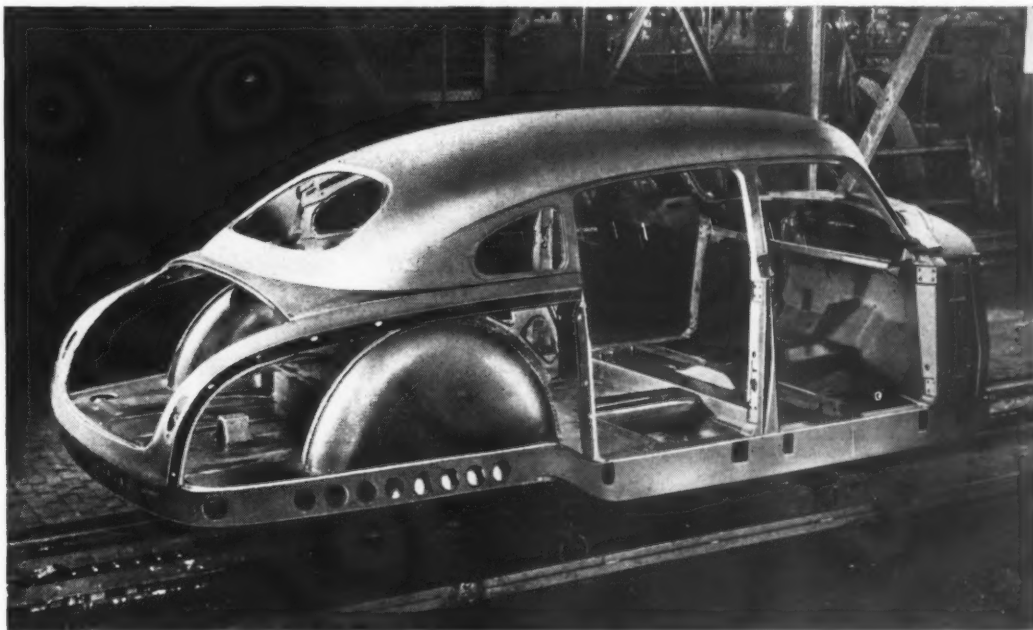
Body headers are welded to reinforcements, for subsequent location under the top and above the doors on each side of the car, on the National resistance welding machine shown in Fig. 10. Left- and right-hand headers are welded simultaneously in one machine. Parts for coupes or four-door sedans are produced in the same machine by simply changing the dies. The back-up dies raise the headers into position against the stationary welding guns.

Special current-carrying welding guns, which eliminate the need for copper air-cooled shunts generally used on gun welders, are employed on

this machine to permit making 144 spot-welds in the limited space available. A wedging action inside the gun completes the secondary circuit when the gun tip comes in contact with the work.

A selector switch enables power to be supplied to all the guns simultaneously or in four impulses. With all guns operating at once, a production rate of 220 pairs per hour is obtained. Nine compact transformers, each of 30-KVA rating, are located along both sides of the welder. Heat regulation is accomplished by adjusting the three auto-transformers shown on top of the machine.

Completed "Monobilt" Body-and-frame, Joined by More than 5300 Spot, Arc, and Acetylene Welds, Rolls onto the "Body-in-white" Line for Fitting the Doors and the Fenders, Finishing, and Painting



Salvaging Fifty-six Tons of Sheet Metal per Day

In a Plant Using Five Hundred Tons of Sheet Steel to Produce 1250 Automobiles per Day, Enough Material is being Salvaged to Make an Extra Car in Every Fifty – Practice Employed at the Buick Motor Division of the General Motors Corporation

ASERIOUS shortage of sheet steel is causing critical bottlenecks in automotive as well as in other fields of production. To alleviate such shortages, the Buick Motor Division of General Motors Corporation has undertaken a comprehensive program aimed at utilizing every possible square inch of sheet metal that comes into the plant. By producing smaller stampings from the unused material resulting from previous operations, a substantial amount of sheet steel is now going into automobiles that was formerly sold as scrap.

More than 500 tons of steel are used to produce over 700 parts for 1250 automobiles per day. The amount of material and salvage used for one car is as follows:

Virgin material purchased.....	878.78 pounds
Material used in one car.....	465.35 pounds
Material available for salvage...	413.43 pounds
Salvage used per car.....	88.90 pounds

It will be seen that almost 22 per cent of the available salvage material is being utilized for production parts.

During 1947, approximately 8500 tons of sheet steel was salvaged by restamping. If returned to the steel mills as scrap for remelting, the steel would have a value of about 1.5 cents a pound. As virgin material costs approximately 4.25 cents per pound, this represents a considerable saving in money.

Some of the automotive parts that are produced entirely from salvage are listed in Table 1.



Each such part is given a salvage symbol or symbols, which are listed on the material record cards. A record of the salvage material is supplied to the purchasing department. With this data on the salvage available, the amount of material purchased can be reduced.

Regular weekly meetings are held at the plant, during which records are compared and suggestions made by inspectors, foremen, and production engineers for further utilizing salvage material. An attempt is made to create a competitive spirit between the workmen of various departments to reduce scrap and produce more parts from less material. Product design changes and drawings of all new dies are examined from a part-salvage viewpoint. The attempt is made to visualize a use for the salvage that will be available from the new die, since it is more practical to change the design of the part or die at this point than to wait until it is in operation. To obtain the most effective results, close cooperation is necessary between the tool engineer and the product designer.

Production of a minimum amount of scrap is one of the principal means of making the fullest possible use of sheet metal. Suitable blank development and scrap-strip design, correct die construction, the use of careful operators, adequate and frequent inspection, and improved methods of material handling are the chief ways of minimizing scrap, reducing costs, and increasing production. The importance of using the most economical scrap-strip lay-out cannot be overemphasized. Equally important is the re-use of surplus metal resulting from the numerous stamping, blanking, and drawing operations.

Material-handling costs must be considered when the available material on the salvage sheet is small. In some cases, it is more economical to purchase a large sheet for the multiple-production of small parts than to attempt to stamp a few pieces from a used strip.

To integrate the requirements for the 700 different parts—ranging in size from small washers to large hoods—needed for each automobile,

SALVAGING FIFTY-SIX TONS OF SHEET METAL PER DAY

Table 1. Some Automotive Parts Made of Sheet Steel Salvaged from Other Operations

Part Name	Salvage Symbol Number	Gage, Inch	Salvaged from
Washer, Plain	49-004	0.060	Crankcase Corner
Cover, Plate	49-031	0.039	Front-fender Upper Side Panel
Plug	49-030	0.039	Torque Ball Retainer
Reinforcement, Gas Tank	49-006	0.135	Clutch Cover
Plug	49-004	0.060	Crankcase Corner
Sleeve, Crankcase Ventilator Inlet	49-055	0.0345	Front-fender Skirt
Nut, Differential Adjusting	49-052	0.245	Transmission Mounting Thrust Plate
Slinger, Clutch-gear Oil	49-021	0.0255	Fresh Air Duct
Guard, Front Brake Dirt	49-034	0.039	Front-fender Side Panel
Disk, Harmonic Balancer Weight.....	49-003	0.120	Clutch Cover
Washer, Special	49-001	0.120	Harmonic Balancer Disk
Washer, Special	49-001	0.120	Harmonic Balancer Disk
Baffle, Lower Crankcase, Rear	49-030	0.039	Front Fender
Baffle, Lower Crankcase, Rear	49-034	0.039	Front-fender Side Panel
Hinge, Rear-fender Door	49-019	0.050	Front Fender
Washer	49-002	0.0287 0.0312	Side-Gear Thrust Washer
Washer, Pilot	49-038	0.039	Front-fender Side Panel
Baffle, Lower Crankcase, Front	49-030	0.039	Front Fender
Washer, Special	49-005	0.120	Clutch Cover
Shedder, Front-wheel Oil	49-025	0.050	Front Fender
Disk, Harmonic Balancer Weight	49-010	0.0345	Rear Fender
		0.045	Cover Sheets
Cap, Hub Grease-retaining	49-025	0.050	Front Fender
Plate, Pedal	49-042	0.0345	Rear Fender
Plate, Transmission Control Lever Housing, Thrust	49-004	0.060	Crankcase Corner

Table 2. Sheet Steel Sizes Purchased for Automotive-Part Production,
Listed in Order of Thickness and Size

Gage, Inch	Width, Inches	Length, Inches	Plant	Specification	Part Name
0.0345	28	56	12	SAE 1008 Range CRS-O-MR-CQ	Front-fender Gravel Deflector
0.0345	28	57 1/2	12	SAE 1008 Range CRS-O-MR-CQ	Front-fender Gravel Deflector
0.0345	29	64 1/4	12	SAE 1008 Range CRS-O-MR-CQ	Harmonic Balancer Weight Disk
0.0345	29 1/2	44 1/2	12	SAE 1008 Range CRS-O-MR-EDD	Front-fender Extension
0.0345	30 1/2	60 1/8	12	SAE 1008 Range CRS-O-MR-CQ	Harmonic Balancer Weight Disk
0.0345	31 1/2	Coils	12	SAE 1008 Range CRS-O-MR-CQ	Rear-fender Inner-panel Extension
0.0345	32	64	12	SAE 1008 Range CRS-O-MR-CQ	Rear-bumper Gravel Deflector (Body Section)
0.0345	33 3/4	57 1/2	12	SAE 1008 Range CRS-O-MR-CQ	Underseat Heater Cover
0.0345	35	52 3/4	12	SAE 1008 Range CRS-O-MR-EDD	Rear-fender Extension
0.0345	35 1/2	64	12	SAE 1008 Range CRS-O-MR-CQ	Rear-fender Wheelhouse Bolt Flange

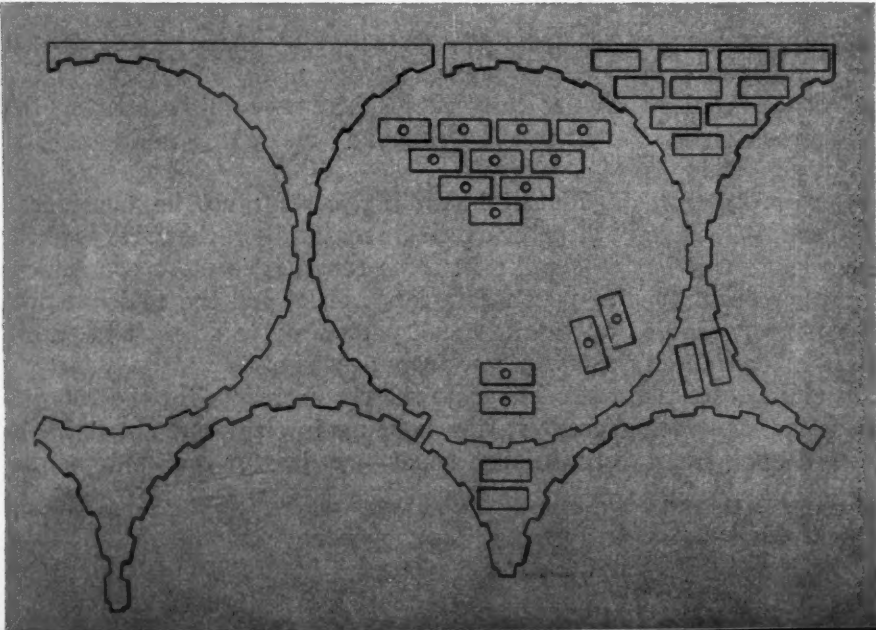


Fig. 1. Salvage Sheet Steel, 0.105 Inch Thick, is Restamped to Produce Fourteen Rectangular Washers. Scrap is Shown at Right

SALVAGING FIFTY-SIX TONS OF SHEET METAL PER DAY

Fig. 2. Stamping Operation in which the Rectangular Washers Shown in Fig. 1 are Produced. An Open Die Permits the Part to be Shifted at Will



various breakdowns are made with relation to size of parts, part numbers, size of sheets purchased, etc. Since the primary consideration in making a part from used strip stock or scrap blanks is the gage or thickness of the material, this information is listed in the first column on the breakdown of sheet-steel sizes purchased. One of the forty-five pages listing these sheet sizes is shown in Table 2.

Thicknesses specified for the parts can be decreased in many cases due to the increased tensile strength of the metal being salvaged. Such an increase in strength, varying from 10 to 25 per cent, results from cold-working during the drawing or rolling (flattening) operations. By

this means, 0.031 inch thick metal has been used for parts originally specified to be 0.042 inch thick, and draw-ring salvage 0.050 inch thick has been substituted for 0.075 inch thick virgin metal.

In other instances, engineering changes in the size, shape, or thickness of the part have been made to permit utilization of strip stock that would otherwise be scrapped. Sometimes blanked metal sheets have been welded together, in double or triple thicknesses, to produce the desired part. A disadvantage of this method is that the blank punched from the top layer of metal actually punches the lower sheet, resulting in an increased burr and poor die life.

Fig. 3. Eight Blanks for Rear-fender Door Hinges are Obtained from 0.050-inch Thick Salvage Resulting from a Front-fender Stamping Operation



SALVAGING FIFTY-SIX TONS OF SHEET METAL PER DAY

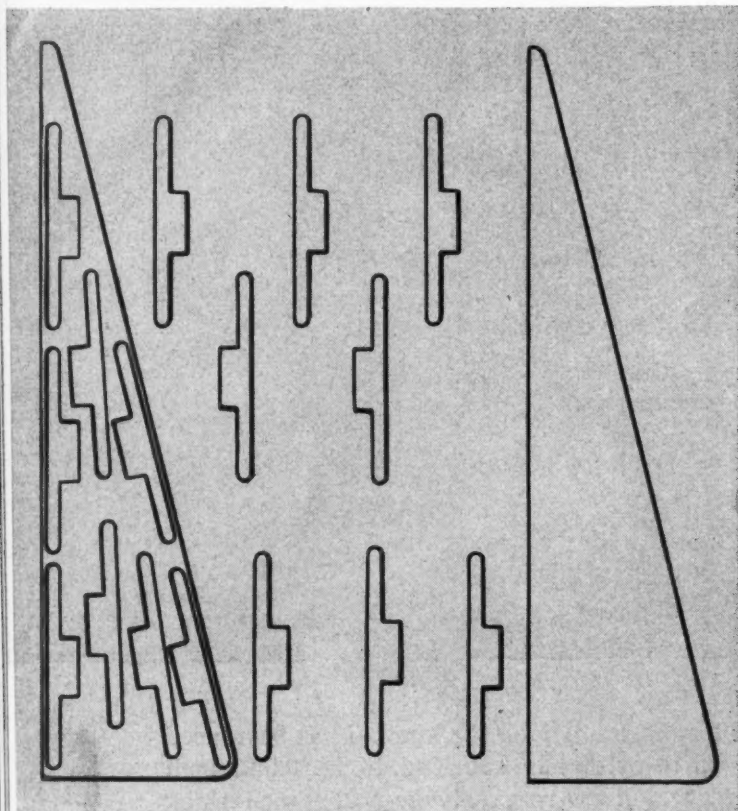


Fig. 4. Scrap Strip (Left) Produced in Stamping Eight Rear-fender Door Hinges from Front-fender Salvage Shown at Right

Since there is more salvage material available than can be used, as large a part as possible is first made from the salvage piece. In extreme cases, relatively thick sheets of salvage material are lap- or flash-welded together to form a larger piece. It is generally impractical to pass coil stock through a die more than once because of the difficulties and cost of handling.

Rectangular washers are produced from 0.105 inch thick salvage, Fig. 1, in the press operation shown in Fig. 2. The strip produced in a previous blanking operation is sawed into sections to facilitate handling. An open die, without gages or stops, is used whenever possible, to permit the operator to move the piece about freely and thus take full advantage of the salvage material available. A scrap piece from which the washers have been stamped is seen at the right in Fig. 1, while the completed washers are shown at the left of the scrap piece.

Eight blanks, which are subsequently formed into rear-fender door hinges, are obtained from each piece of salvage resulting from a front-fender stamping operation. The restamping operation, again performed in an open type die, is shown in Fig. 3. A 0.050-inch thick piece of front-fender salvage, eight hinge blanks, and a scrap strip produced in restamping are shown from right to left in Fig. 4. The salvage material is placed manually in the open die with the burr side of the sheet upward to avoid wearing burr grooves in the die.

Harmonic balancer weight disks are produced from 0.0345-inch thick rear-fender salvage, Fig. 5, and 0.045-inch thick cover sheets. Six

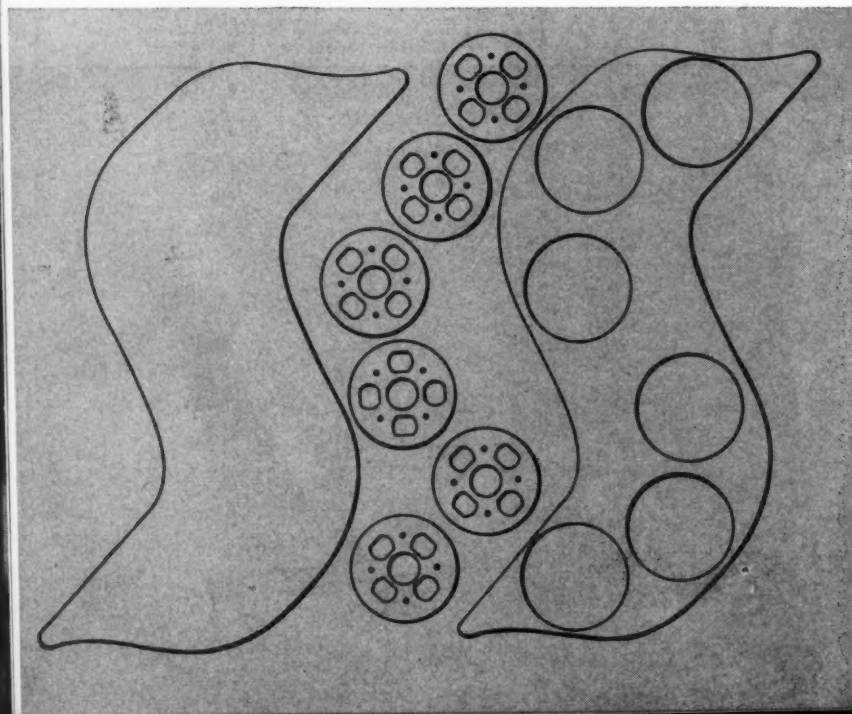


Fig. 5. Six Harmonic Balancer Weight Disks are Obtained from Each Sheet of Rear-fender Salvage

SALVAGING SHEET METAL

of the disks are blanked and punched from each piece of rear-fender salvage by means of the set-up shown in the heading illustration. Since two such salvage sheets are available per car, the entire requirements for balancer disks are satisfied without the purchase of any additional material.

Large sheets of steel, such as scrap hoods or draw-ring salvage, are cut into small sections on a band-saw (Fig. 6), or on a squaring shear to facilitate handling. Draw-rings or drawn portions of scrap parts are flattened by passing them between power-driven rolls.

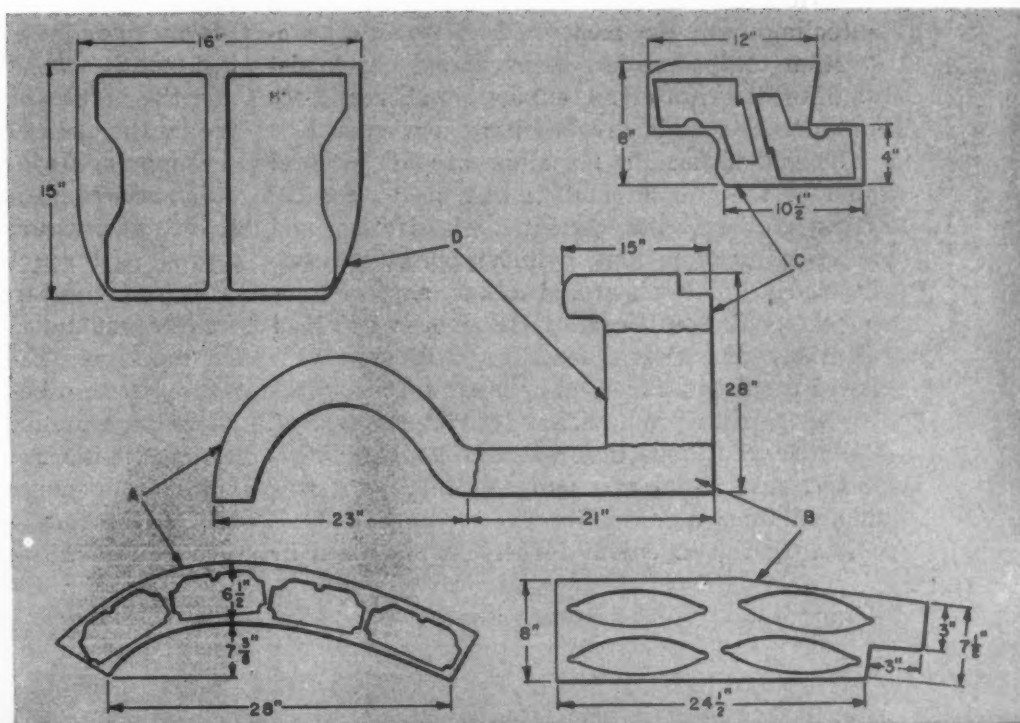
Draw-ring salvage from both right- and left-hand front-fender side panels, such as the piece shown in the center of Fig. 7, is sawed into four segments and rolled flat. The material is extra deep-drawing (annealed), cold-rolled steel, 0.039 inch thick, and two such units are available from each car produced.

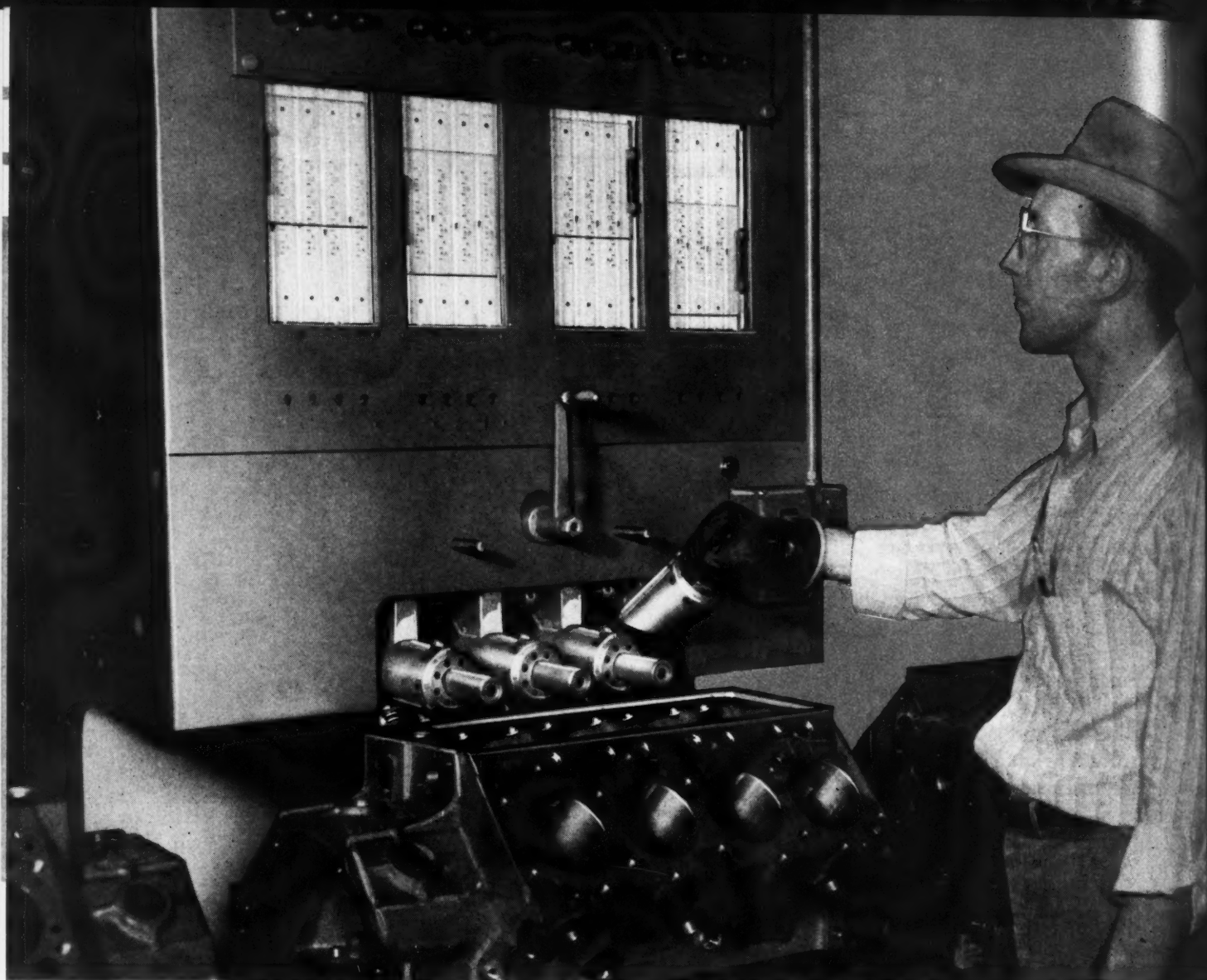
From each flattened piece of salvage material seen at A, four baffle blanks are stamped. Since only one such baffle is required per car, the same piece of salvage is used to stamp eight front-fender support shields or four front-brake dirt guards, depending upon production requirements when the salvage becomes available. Flattened salvage segment B is restamped to provide four hood-reinforcement brackets. Two brake-pedal shields are obtained from piece C, and two front-fender supports from D. Scrap parts that cannot be salvaged and salvage material that has been restamped are baled for sale as scrap steel.



Fig. 6. Large Steel Sheets (Scrap Parts or Salvage Material) are Sawed into Smaller Sections to Facilitate Handling

Fig. 7. Draw-ring Salvage from Front-fender Side Panels (Center) is Sawed into Four Parts for Restamping





AN outstanding feature of Oldsmobile's 1949 Series 90 automobiles will be an entirely new high-compression V-8 engine. The compression ratio of the new power plant will be approximately 7.25 to 1, compared to 7 to 1 for the in-line eight-cylinder engine. Complete retooling with the most modern types of production equipment has been carried out in designing the Kettering engine plant for mass production of this revolutionary new engine.

Unique inspection machines are an integral part of the V-8 production line, providing for rapid and accurate checking, classifying, and segregating of pistons, cylinder bores, connecting-rods, piston-pins, and other engine components. Closer tolerances have been specified on many dimensions, compared with those allowed for the in-line eight-cylinder engine, without sacrificing production. In fact, several of the advanced inspection methods employed represent substantial gains in efficiency and production time.

Among the ingenious inspection machines in

this production line is the multiple-spindle Sheffield Precisionaire inspection machine seen in Fig. 1. In this machine, each cylinder bore in the block is accurately checked at four different positions and stamped with the proper classification for selective assembly with a matching piston. Diameter, out-of-roundness, taper, and bell-mouth of all the cylinder bores are checked and the bores are classified in less than a minute by the use of one machine.

Compressed air, which has been passed through automatic compensating pressure regulators to reduce its pressure to 10 pounds per square inch, as well as through a water trap to remove any entrained moisture, enters the sixteen vertical, transparent indicator tubes shown at the top of the machine. The tubes are grouped into four sets of four tubes, each set being employed to inspect a separate cylinder bore on one side of the engine block.

Air from each set of four tubes is carried to one of the four angular bore-gaging spindles, seen in Fig. 2, each of which enters a cylinder

Inspecting Oldsmobile's New V-Eight Engine

**Unique Inspection Machines Automatically Gage
Cylinder Bores and Pistons, Simultaneously Classi-
fying Them for Selective Assembly. Highest
Quality is Insured without Sacrificing Mass Pro-
duction of the New High-Compression Engine in
the Kettering Engine Plant**

**By S. C. STARNAMAN
Chief Inspector, Oldsmobile Division
General Motors Corporation
Lansing, Mich.**

bore when the block is being inspected. Every spindle has four cylindrical plugs that are 0.001 inch smaller in diameter than the specified minimum cylinder bore diameter. The plugs are located, from bottom to top of each spindle, so that they align with the bottom diameter of the bore and the bore positions corresponding to the lower, central, and upper travel limits of the piston.

The size of the cylinder bore at these four locations is thus inspected by each set of tubes. Air from the left-hand tube in each set flows into the lowest cylindrical plug on each spindle, and thus the diameter at the bottom of the cylinder bore is checked by these tubes. Similarly, the second, third, and fourth tubes in each set check the diameter of the bore at the lower, central, and upper limit of piston travel.

Each cylindrical plug on the gaging spindles contains two diametrically opposite orifices through which the air is ejected. The volume and velocity of air flowing up each tube depends upon the distance from the orifices to the wall of the cylinder bore. The greater this distance, the higher the velocity. A magnesium float in each of the transparent indicating tubes is free to rise in the tube with an increase in the velocity of the air or to fall when the air velocity decreases. Each float rises approximately $\frac{3}{16}$ inch in its respective tube for every 0.0001 inch that the cylinder bore diameter is above the minimum specified size.

Classification symbols AA, A, BB, B, CC, C, DD, and D are marked along the right-hand side of each tube. The difference between any two successive graduation lines represents a 0.00025-

INSPECTING OLDSMOBILE'S NEW V-8 ENGINE

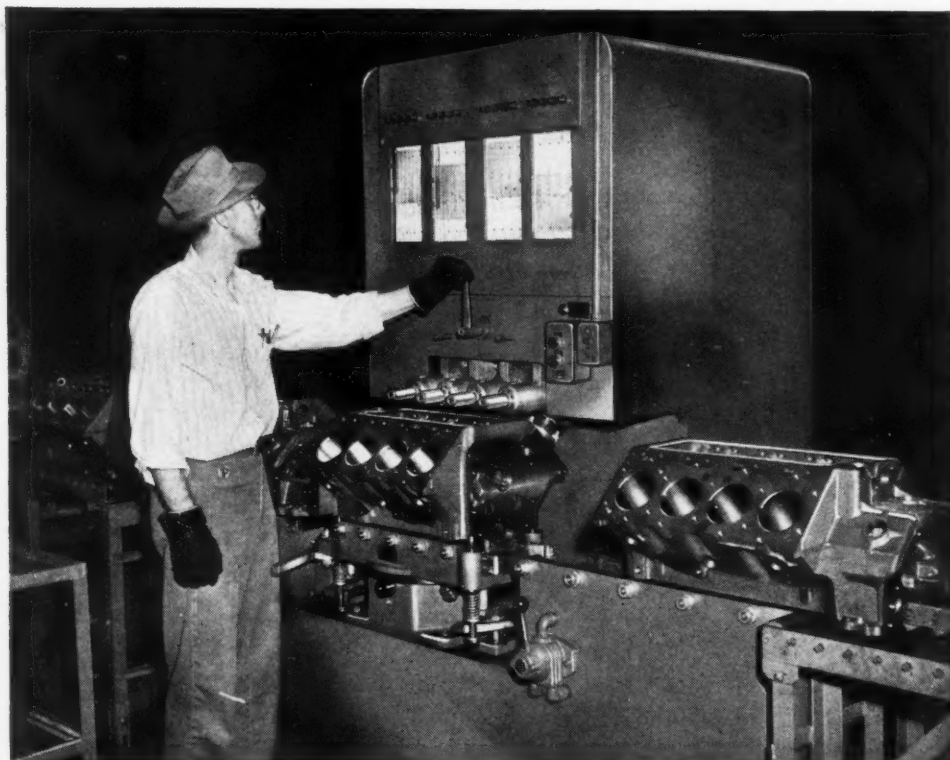


Fig. 1. Multiple-spindle Inspection Machine for Checking the Diameter, Out-of-roundness, Taper, and Bell-mouth of the Cylinder Bores in V-8 Engine Blocks

inch difference in the diameter of the cylinder bore. The total range of the eight classifications represents the maximum permissible tolerance on the bore diameter, which is 0.002 inch.

Across each set of tubes is a transparent slide that can be adjusted vertically on friction ways. Three horizontal lines are engraved on each slide. The height from the lowest to the top line represents a 0.001-inch difference in bore diameter, which is equal to the taper permitted in the over-all length of the cylinder bore. The slides are adjusted vertically to insure that all four floats in each set are within the upper and lower scribed lines on the slide. Also, the float in the left-hand tube of each set must be lower than or even with the floats in the other three tubes to permit subsequent assembly of the piston in the cylinder bore.

The distance between any two adjacent lines on the transparent tolerance slide represents a difference in bore diameter of 0.0005 inch, corresponding to the permissible out-of-round limit. The floats in each tube must remain within these limits while the gaging spindles are rotated through an angle of 180 degrees by a crank-

handle located beneath the indicating tubes. Because of the two diametrically opposite orifices, out-of-roundness inspection is obtained through a full 360 degrees.

Cylinder bores are classified with regard to the position of the float in the right-hand tube of each set, which indicates the diameter of the cylinder bore at a point corresponding to the upper limit of piston travel. The size is determined to the nearest 0.00025 inch, as indicated by the classification letters on the graduated scale that are nearest the float in the right-hand tube.

The classification symbol is stamped on the engine block directly beside the cylinder bore thus classified by means of manually operated individual marking devices mounted directly above each of the gaging spindles, as seen in the heading illustration. A marking ring on these devices has raised letters for the various classifications around its periphery, and can be rotated to the desired marking by turning a knurled handle. This stamped piston information is teletyped at intervals to a receiver in the piston sub-assembly area to facilitate making up sets

INSPECTING OLDSMOBILE'S NEW V-8 ENGINE

of pistons to match each particular block as it comes along the assembly line.

Cylinder bores are inspected after they have been rough- and finish-honed, the engine blocks being carried to the inspection machine on a roller conveyor. With a block in position on the turntable of the inspection machine, a lever is actuated to slide hydraulically operated shot-pins into machined holes in the block for accurate locating and rigid clamping.

The four electrically operated gaging spindles are then lowered into the cylinder bores along one side of the V-8 block by depressing a push-button. If any one of the four spindles fails to enter its corresponding bore freely, due to metal chips, an under-size bore, or excessively inaccurate spacing, a micro-switch will automatically stop the downward travel of all four spindles and a red bulb will light above the bore causing interference.

After inspecting one bank of four cylinder bores, another button is depressed to raise the gaging spindles. The turntable is then rotated through an angle of 180 degrees and the gaging spindles are lowered into the opposite bank of cylinder bores. When these bores have been inspected, the shot-pins are retracted, and the next block to be inspected is moved onto the turntable, pushing the inspected block onto the roller conveyor leading away from the machine.

Special Pratt & Whitney Air-O-Limit gages, Fig. 3, are used to check the inside diameters of the five camshaft bushings, the five main bearings for the crankshaft, and the two distributor pilot-holes of the cylinder blocks. The camshaft bushing gage has a long spindle with five sets of air nozzles properly spaced along its length, so that when the spindle is inserted in the cylinder block, the five

bushing diameters are measured simultaneously. The inspector can read the exact size of each bore on five indicators mounted on the face of an air supply cabinet.

A similar gage, with five sets of air nozzles on a long spindle, is employed to check the five main bearing diameters in the engine block. With this gage, however, the inspector not only checks the five diameters simultaneously, but also grades the rear main bearing diameter into one of two classifications which differ from each other by 0.0005 inch. This classification facilitates final assembly by enabling the proper size crankshaft to be matched with the corresponding bearing diameter in the cylinder block. Both these gages for camshaft bushings and main bearings are suspended from counterbalances at the machine where the holes are finished.

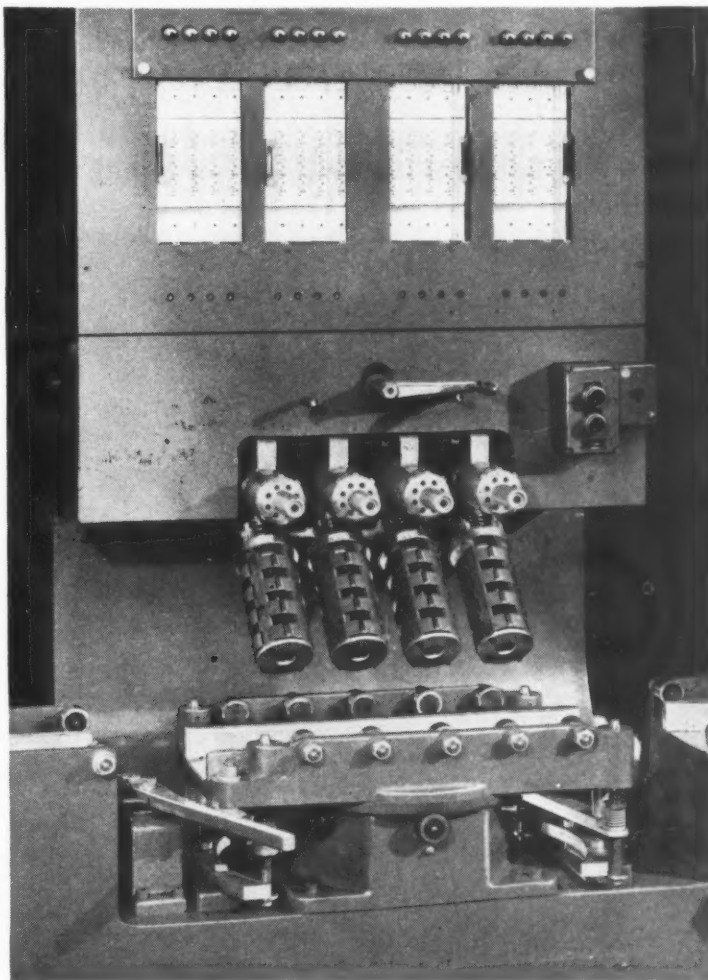


Fig. 2. Close-up View of the Inspection Machine Seen in Fig. 1. Each of the Four Angular Gaging Spindles Enters a Cylinder Bore when Block is Inspected

INSPECTING OLDSMOBILE'S NEW V-8 ENGINE

Distributor pilot-holes are inspected by means of a two-station hand type gage, which is used at the finish-boring machine. All three of these special air gages have calibrated scales on the indicating meters with a magnification of approximately 1500 to 1, which enables the inspector to read the size of the bore within 0.0001 inch.

All important dimensions on the piston are inspected simultaneously, prior to plating and final machining, on the Sheffield "Multichek" machine seen in Figs. 4 and 5. The diameters and widths of the ring grooves on the pistons, as well as the top land diameter, skirt diameter and taper, and squareness of the skirt axis with the head of the piston, are checked at the rate of 500 pistons per hour. The dimensions to be inspected are indicated on a diagram of the piston located on the light panel at the top of the machine.

The widths of the three ring grooves, maintained within ± 0.001 inch, are gaged by "Go" and "No Go" floating feeler members that operate separately against individual micro-switches (Fig. 5). Diameters of the top ring-groove land

and the first and third ring grooves, held to a tolerance of ± 0.0005 inch, are checked by caliper gaging heads. The gaging heads employ a mechanism which consists essentially of two metal blocks—one fixed and one floating—joined by two special alloy-steel reeds. A vertical reed is attached to the top of each block, at the inner edges, and the upper ends of these vertical reeds are joined to a pivoted needle, which is free to swing from side to side.

At both ends of the arc through which the needle swings are electrical contacts that make circuits on one side with a red signal light, indicating that the dimension is under size, and on the other side with a green signal light, indicating over size dimensions. When the needle swings anywhere between these two points, neither signal will light, which shows that the dimension is within the required tolerance.

The diameter and taper of the piston skirt, and the squareness of the skirt axis with the head of the piston are checked by combination air and electric gaging heads, which also actuate signal lights. All of the gaging heads and micro-switch light circuits are integrated into one

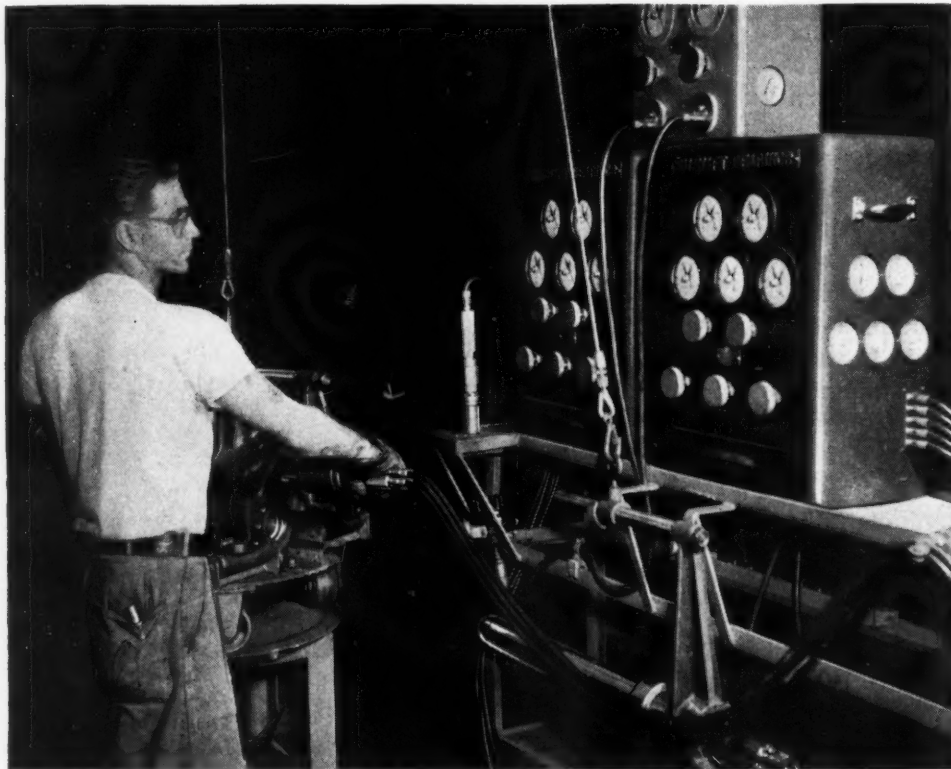


Fig. 3. Inside Diameters of the Five Camshaft Bushings, the Five Main Bearings, and Two Distributor Pilot-holes of the Engine are Inspected with Multiple-plug Type Air Gages

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master light, seen at the lower left of the panel. If all dimensions are within tolerance, the master is illuminated white and all of the individual lights are blacked out. If one or more of the dimensions are beyond the specified limits, the master turns red and the individual signal lights show which dimensions are over or under size.

After final machining and plating, the piston-pin holes and piston skirts are again inspected and then classified on the Multichek seen in Figs. 6 and 7. The pistons are automatically stamped in two places with the proper classifications, based on the diameters of the piston-pin holes and skirt. Inspection and classification are performed at the rate of 500 pistons per hour.

The average diameter of the piston-pin hole is checked at two locations—one place in each bearing—by a double-column Precisionaire spindle, as seen in the close-up view, Fig. 7. The spindle actuates two combination air-electric gaging heads that control the automatic motor-driven mechanism at the left for stamping the proper number on the piston.

Piston-pin holes are grouped into one of four

classifications differing from each other by 0.0001 inch in diameter. If the hole in one side of the piston varies sufficiently from that in the opposite side to place the piston in two different classifications, the larger diameter hole determines the classification stamped on the piston.

The diameter at the bottom of the piston skirt is simultaneously checked by another combination air-electric gaging head, which controls the motor-driven mechanism at the right for automatically stamping the proper letter or letters on the piston.

Piston-skirt diameters are grouped into one of eight classifications bearing the same letters employed for classifying the cylinder bores. The piston-skirt diameter classifications vary by 0.00025 inch. When the proper classification has been determined, a signal light is automatically illuminated under the gravity chute bearing this classification. It is then merely necessary for the operator to remove the piston from the inspection machine and place it in the chute having the illuminated light beneath it. The light remains on until the next piston to be checked is located in the gaging position.

Fig. 4. Four Different Diameters of the Piston, Three Groove Widths, Taper of the Skirt, and Squareness of the Skirt Axis with the Head are Inspected at the Rate of 500 Pistons an Hour



INSPECTING OLDSMOBILE'S NEW V-8 ENGINE

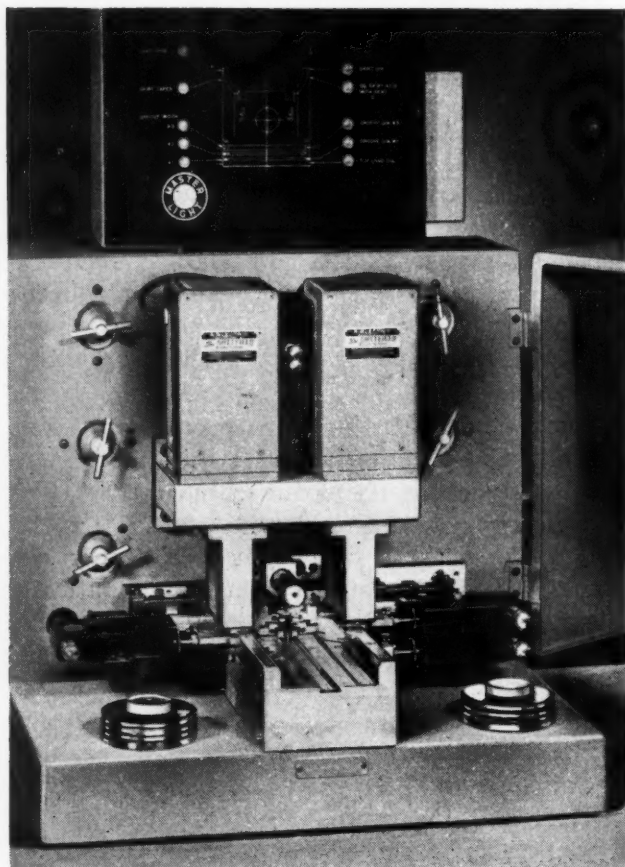


Fig. 5. Gaging Details of Inspection Machine in Fig. 4. Lights on Panel are Connected by Lines to Dimensions on Piston Diagram being Inspected. Red Lights Indicate Under-size and Green Lights Over-size Dimensions

A 100 per cent inspection of the volume capacity of cylinder-head cavities for the V-8 high-compression engine is made on a new inspection machine—the Poole Cavitometer—seen in Fig. 8. This machine is capable of inspecting cylinder heads at the rate of 100 per hour. Differences in volume capacities are measured with an accuracy of one part in 1500.

The Cavitometer records the volume capacity of the cylinder head by measuring sonic vibrations too faint for the human ear to detect. It replaces the previous method of measuring the volume capacity by pouring a fluid into the cavity of the engine block and then measuring the cubic centimeters it contained by means of a graduated glass.

The principle upon which the Cavitometer is based is that all cavities with a certain volume capacity have a natural frequency at which they will resonate. A common application of this principle is the pipe organ. When the motor-block head is placed in the Cavitometer, it reflects a sonic wave that is compared with the known sonic frequency of a master cylinder-head cavity. The difference between these two is interpreted in volume measurement and is indicated on a dial. The various cylinder-head cavities are measured automatically in sequence. If any of them are “out of volume,” this is indicated on the dial directly above the cylinder head, and the machine is stopped so that the operator can make note of it. The head can then be classified for repair or rejection.



Fig. 6. The Pistons are Given a Final Inspection and Classified According to Diameters of Piston-pin Holes and Skirt. Pistons of Different Classifications are Segregated

INSPECTING OLDSMOBILE'S NEW V-8 ENGINE

Crankshafts are checked at the rate of sixty per hour on a multiple-column Precisionaire inspection machine, Fig. 9. Main and pin bearing diameters, the oil-seal diameter, and the width of the rear main bearing are all gaged in one set-up. U-shaped blocks support both ends of the crankshaft. By raising the counterbalanced bar handle at the front of the machine, the five snap type air gaging heads, seen projecting from the top front edge of the machine, are elevated to their inspection positions.

The five main bearings of each crankshaft are checked simultaneously by these built-in air gaging heads. Each head has three pairs of air jets located diametrically opposite each other, so that the diameters of each main bearing are gaged at positions midway between the flanges and at 1/8 inch from each flange. While in the gaging position, the snap type heads can float forward or backward to take care of any misalignment. The various diameters are indicated on the fifteen Precisionaire tubes at the top of the machine.

Simultaneously, the oil-seal diameter of the crankshaft is inspected at one location and the width of the rear main bearing is checked on one of the Precisionaire units seen at the top of the machine. Diameters of the pin bearings are checked separately and manually by means of a portable snap type air gaging head shown in the operator's right hand. This head also has three pairs of air jets. These diameters are indicated on a three-column Precisionaire unit at the left.

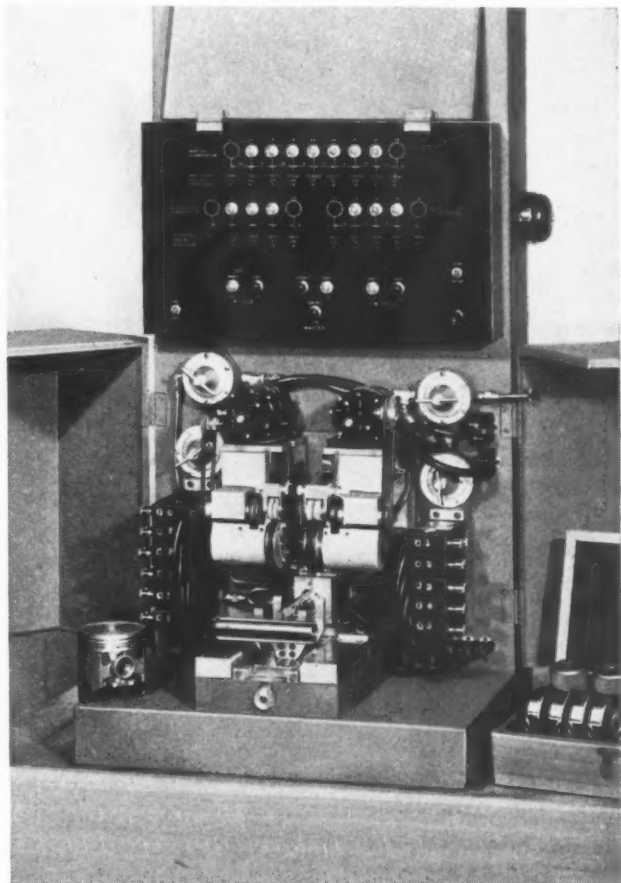


Fig. 7. Close-up View of Machine Illustrated in Fig. 6, Showing Combination Air-electric Gaging Heads that Control Motor-driven Mechanisms for Automatically Stamping Classification Number and Letters on the Piston

Fig. 8. Volume Capacity of Cylinder-head Cavities is Measured by Comparing a Sonic Vibration with the Known Sonic Frequency of a Master Cylinder-head Cavity



INSPECTING OLDSMOBILE'S NEW V-8 ENGINE



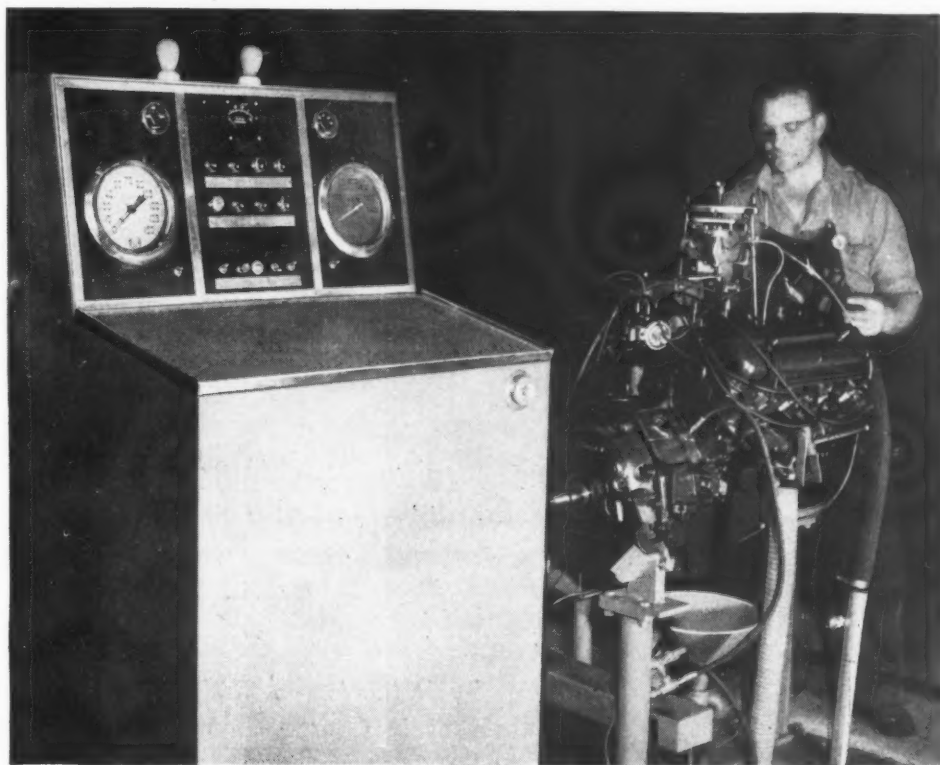
Fig. 9. Main and Pin Bearing Diameters, Oil-seal Diameter, and Width of Rear Main Bearing are Gaged, at Rate of 60 Crankshafts an Hour, on Multiple-column Machine

Fig. 10. Piston-pins are Automatically Segregated into Six Size Classifications at the Rate of 2400 per Hour



INSPECTING OLDSMOBILE'S NEW V-8 ENGINE

Fig. 11. Completed V-8 Type Engines are Given a Water-brake Dynamometer Test on This Machine. Engine Speed and Torque are Shown on the Dial Indicators



Piston-pins are checked for average diameter and automatically segregated according to whether they are under size, over size, or in one of four size classifications on the machine seen in Fig. 10. The rate of inspection is 2400 per hour. The over- and under-size pins are not used in production, but are retained for service requirements. The pins are manually loaded into the chute shown at the left, which prevents parts too large in diameter or longer than specified from entering the machine. Accepted parts fall into a locating V-block, where a motor-driven arm pushes them, one by one, into an air gaging ring.

As each pin comes to rest, it is checked by air jets in the bore of the ring. By means of combination air-electric gaging heads, solenoids are actuated to open and close stops immediately behind the segregating chutes. The inspected pin is pushed through the air ring by the next

piston-pin to be checked, and is carried along by a miniature conveyor belt until it reaches a barrier. The part is then ejected into the proper chute. Piston-pins in consecutive classifications vary in diameter by 0.0001 inch.

Forty water-brake dynamometers like that shown in Fig. 11 are employed for making a 100 per cent inspection of the completed V-8 engines. These dynamometer units, manufactured by Bennett-Feragen, Inc., are set up for automatic cycling at various speeds for a thirty-minute run-in of each engine.

The dynamometer unit automatically shuts off the engine if the oil pressure fails, the engine becomes overheated, or the desired power is not developed. This automatic shut-off system is equipped with lights that indicate to the operator the reason why the engine is shut off. Engine speed and torque are shown by dial indicators on the panel of the test stand.

Building the Peacetime

Outstanding Forging, Machining, and Stamping Operations Employed at the Modernized Plant of Willys-Overland, where the War-Famous Jeep was Produced

By WILLIAM E. PARIS
Vice-President in Charge of Manufacturing
Willys-Overland Motors, Inc.
Toledo, Ohio

ONE of the largest independent automobile factories in the world, modernized since the war, has produced over 300,000 peacetime Jeeps and Jeepsters for varied use in industry and agriculture. Some of the more interesting operations performed in building these cars are described in this article.

The Willys-Overland forge shop occupies nearly 200,000 square feet of floor space and has a capacity of 80,000,000 pounds of forgings per year, based on a twenty-hour working day. Crankshafts for the six-cylinder engine are forged at the rate of forty-five per hour from round-cornered billets, 3 1/4 inches square by 29 inches long, of S A E 1040 steel. Each billet, as shown at the left in Fig. 1, weighs approximately 87 1/2 pounds, while the finished crankshaft, seen at the right, weighs 63.3 pounds.

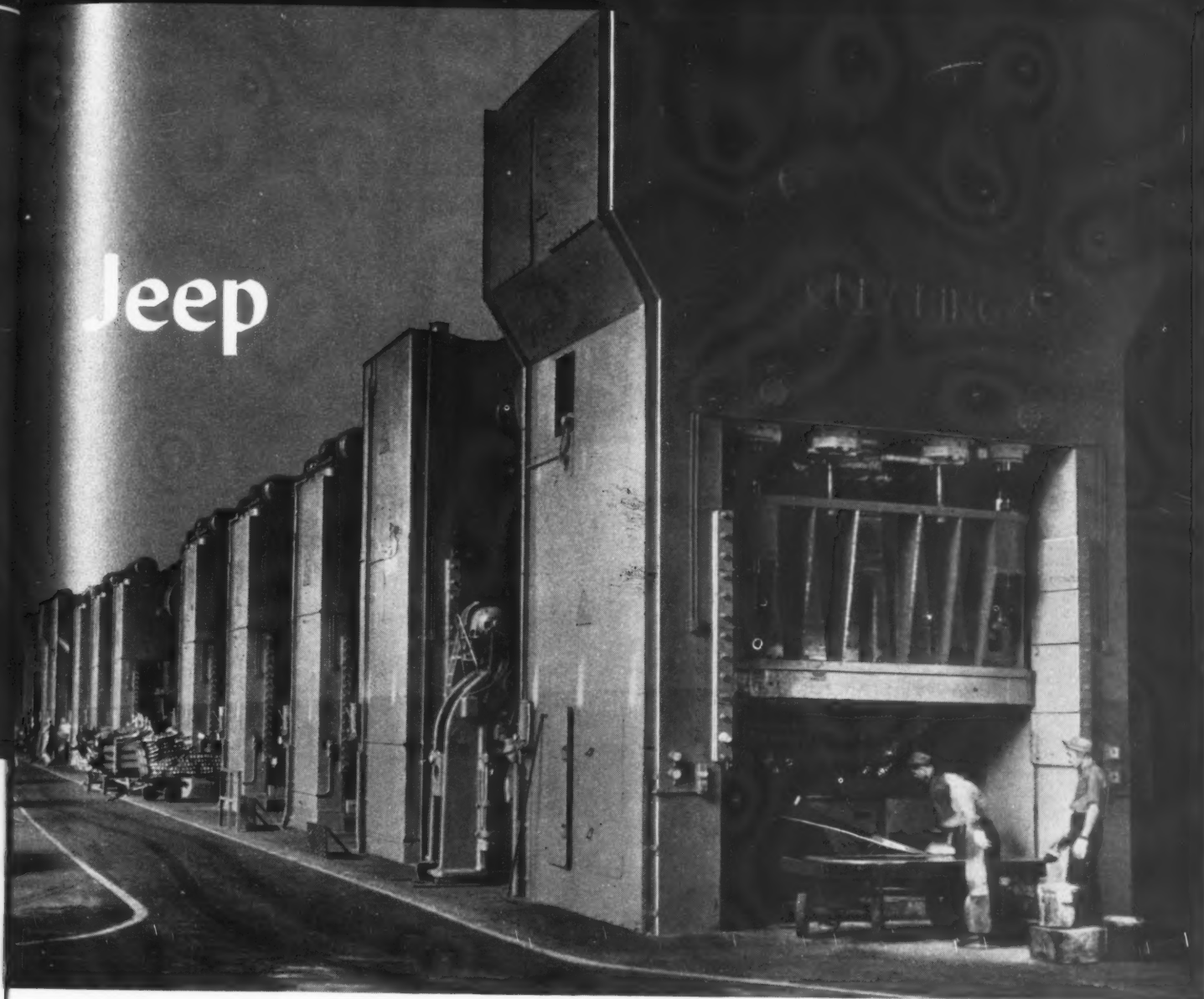
The billets are heated in a combination gas-and oil-fired furnace to a temperature of from 2200 to 2250 degrees F. The hot billet is rolled, edged, and blocked in a 12,000-pound Erie steam hammer. Finish-forging to the shape shown in the center of Fig. 1 is accomplished in a single-

impression die mounted on a Chambersburg 10,000-pound steam hammer, Fig. 2. The forging dies have a life of about 16,000 crankshafts. Steam is employed to remove scale from the dies between forging operations.

After trimming the flash, the forged crankshaft is twisted in a hot-forming press. A second twist is then made in the crankshaft by means of a hydraulically operated rotary fixture. In the final operation, the crankshaft is restruck in a 5000-pound steam hammer. Completed crankshafts are heat-treated at a temperature of 1550 degrees F., quenched in water, and tempered at 1100 degrees F. to obtain a Brinell hardness of approximately 225.

Tubing for the seats, body top bows, exhaust system, oil-filter tubes, and steering column casings is roll-formed, welded, and sized at the rate of 60 feet per minute on the Yoder tube-rolling mill shown in Fig. 3. An average of 125 feet of tubing is used in each car. Coils of cold-rolled steel varying from 16 to 22 gage can be formed into tubing from 1 to 1 5/8 inches in diameter on one machine.

Jeep



As the strip passes through the machine, each of the six pairs of rolls produces a partial change in the cross-section. The open butt-seam tube thus formed is resistance-welded between two vertical rolls at the operator's position. Guide rolls at this location force the edges of the tube together during the welding operation. At the far end of the machine, the tube is sized and straightened between two more pairs of rolls, and then cut to length.

Pin bearings of the crankshafts for four-cylinder engines are finish-ground two at a time on Norton "Twin-O-Matic Hydro" crankpin grinding machines, Fig. 4. The Nos. 2 and 3 pin bearings are finished on one machine, while the Nos. 1 and 4 are ground on a similar machine. A production of thirty-four crankshafts per hour is obtained from each machine, the pin bearing diameters being held within ± 0.0005 inch of the desired size.

Two abrasive wheels, 42 inches in diameter by 1.332 inches wide, are mounted on each machine. Aluminum-oxide abrasive of 60 grain size, N hardness, No. 5 structure, and vitrified

bond is employed. Wheels are dressed after grinding about twenty crankshafts. From 0.020 to 0.030 inch of abrasive is removed in the truing operation, using a 20-grit silicon-carbide abrasive wheel, 8 inches in diameter by 1 1/4 inches wide, of S hardness and vitrified bond. Each pair of wheels will grind approximately four thousand crankshafts before requiring to be replaced.

From 0.030 to 0.042 inch of stock is removed from each bearing diameter at the rate of 0.0005 inch per revolution. The crankshafts are rotated at 65 R.P.M., and full-size grinding wheels at 525 R.P.M. Grinding wheel speed is progressively increased as the wheel diameter decreases from wear to maintain a surface speed of about 6500 feet per minute. Foster "Electromatic" dial indicating gages contact the periphery of the bearings as they are being ground. Only two pin bearings can be ground at once because of the throw of the crankshaft. However, the positions of the grinding wheels can be changed to permit grinding all four pin bearings on one machine should this be desirable.

BUILDING THE PEACETIME JEEP

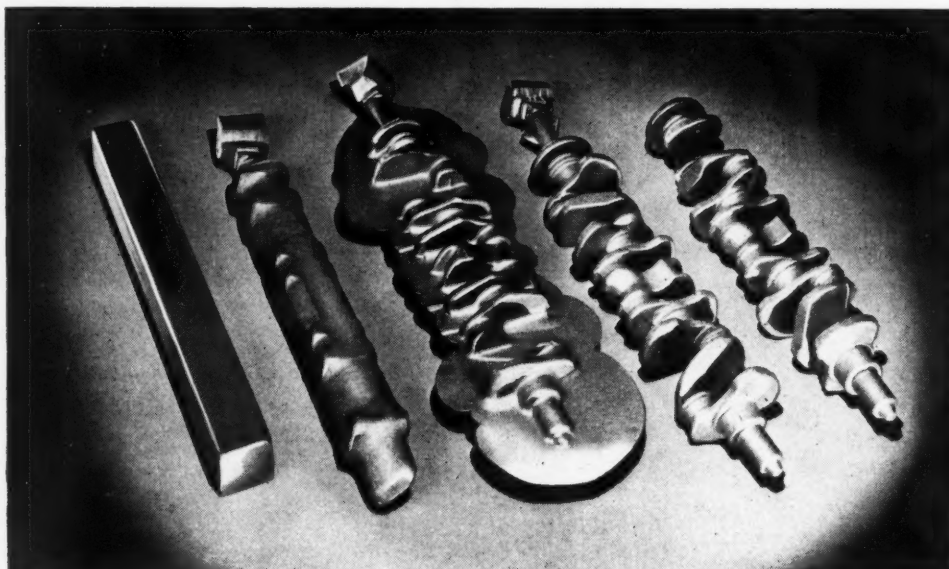


Fig. 1. Round-cornered Billets with a Square Cross-section, Such as the One Seen at the Left, are Progressively Rolled, Edged, Blocked, Finish-forged, Trimmed, and Twisted to Form the Crankshaft Shown at the Right

Half-round bores and joining faces of both connecting-rods and caps are broached at the rate of 130 per hour on the Oilgear 30-ton by 66-inch stroke dual-ram broaching machine shown in Fig. 5. The bore size is maintained within ± 0.001 inch. About $7/32$ inch of stock is removed from the three surfaces on each forging. No further machining is required on the joining faces of the rods and caps, but 0.017 inch of stock is left in the bores for subsequent semi-finish precision-boring and finish-grinding operations.

A rod and cap are both mechanically clamped in the fixtures located in front of each ram. One

fixture is unloaded and reloaded with forgings while the parts in the other fixture are being broached. The dual rams of the machine are hydraulically fed downward at the rate of 32 feet per minute.

Both crankpin and wrist-pin ends of the connecting-rod and cap assemblies are ground to width on a Hanchett three-wheel rotary surface grinding machine, Fig. 6. In this operation, it is necessary to reverse the assemblies and pass them through the machine twice, so as to grind both sides of the parts. A production of 450 assemblies per hour is obtained. The width of the parts is held to ± 0.002 inch.



Fig. 2. A Single-implosion Die, Mounted on a 10,000-pound Steam Hammer, Finish-forges Crankshafts for Six-cylinder Engines at Forty-five per Hour

BUILDING PEACETIME JEEPS

Fig. 3. Automotive Exhaust Tubing, 1 5/8 Inches in Diameter, is Roll-formed, Welded, and Sized at the Rate of 60 Feet per Minute on This Tube-rolling Mill

The rod and cap assemblies are first located in the odd-numbered stations of a forty-station automatic clamping fixture. After passing beneath the three grinding wheels, which remove 0.013 inch from one side of the parts, the assemblies are reversed and located in the even numbered stations of the fixture. These stations are made 0.013 inch higher than the odd stations, so that this amount of stock will be removed from the opposite sides of the parts as they pass under the wheels for the second time.

Resinoid-bonded grinding wheels, 20 inches in diameter by 3 inches thick, having a 54 grain size, N hardness, and 6 structure are employed. The grinding wheel feed is automatically adjusted for wheel wear by means of a sizing gage. Ammeters seen mounted at the top of the machine indicate whether each wheel is operating properly:

The crankpin ends of the connecting-rod and cap assemblies are semi-finish-bored and the piston-pin holes are simultaneously finish-bored at the rate of 330 per hour on a Heald six-station "Borematic," Fig. 7. Both the piston-pin hole and the crankshaft bearing bore are maintained within ± 0.001 inch. Connecting-rod and cap assemblies are located in every other station of a six-station automatic, hydraulically actuat-

ed clamping fixture while parts in the other three stations are being bored.

Six boring spindles are provided on the machine, three for boring the crankpin end and three for the piston-pin holes. Each boring-bar holds two carbide-tipped tool bits that are fed at the rate of 6 1/2 inches per minute and remove 0.017 inch of stock from each bore. The spindles for boring the crankpin ends are rotated at 786 R.P.M., while the wrist-pin boring spindles revolve at 2068 R.P.M. Soluble oil in

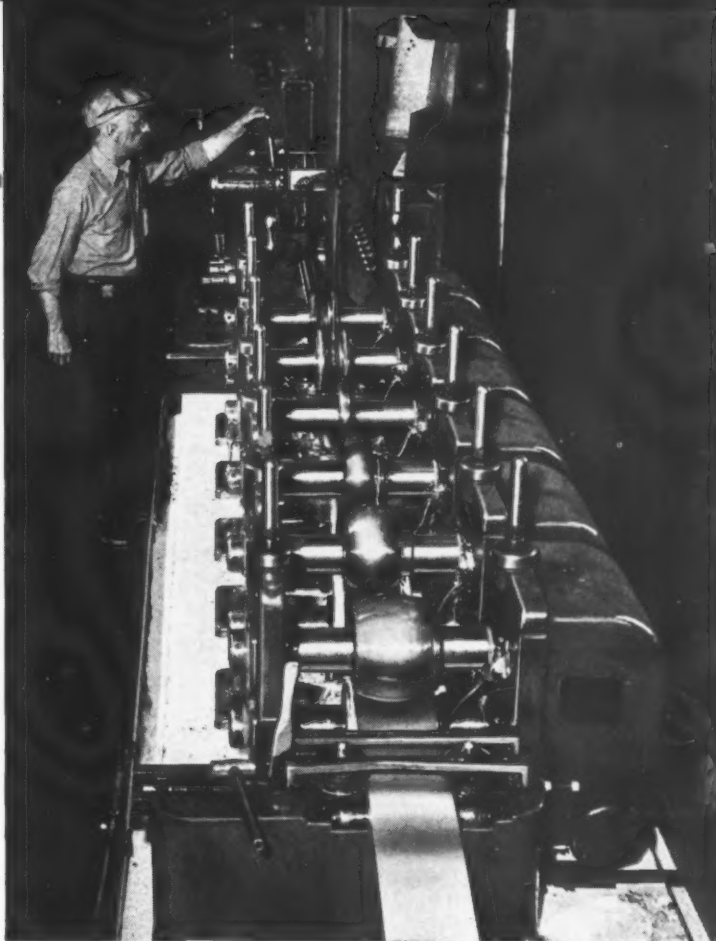


Fig. 4. The Crankpin Bearings are Finish-ground Two at a Time on the Dual-wheel Grinding Machine Here Illustrated at the Rate of Thirty-four Crankshafts per Hour

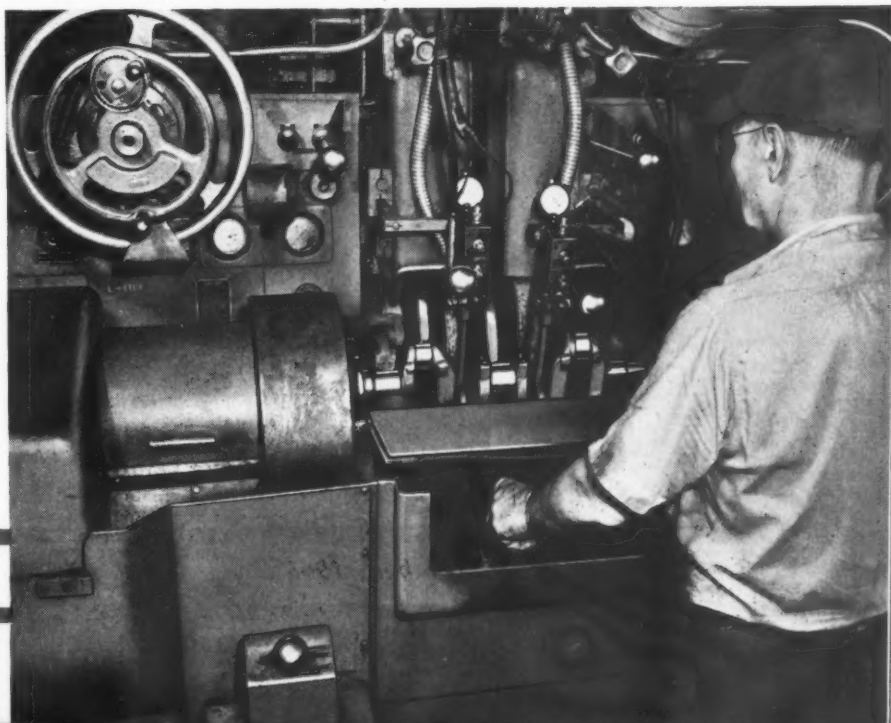




Fig. 5. Half-round Bores and Joining Faces of Connecting-rods and Caps are Broached at the Rate of 130 per Hour on a Dual-ram Broaching Machine Equipped with Four Broaches

Fig. 6. A Forty-station Automatic Clamping Fixture, Mounted on the Rotary Table of a Three-wheel Surface Grinder, is Employed in Grinding Connecting-rod and Cap Assemblies to Width

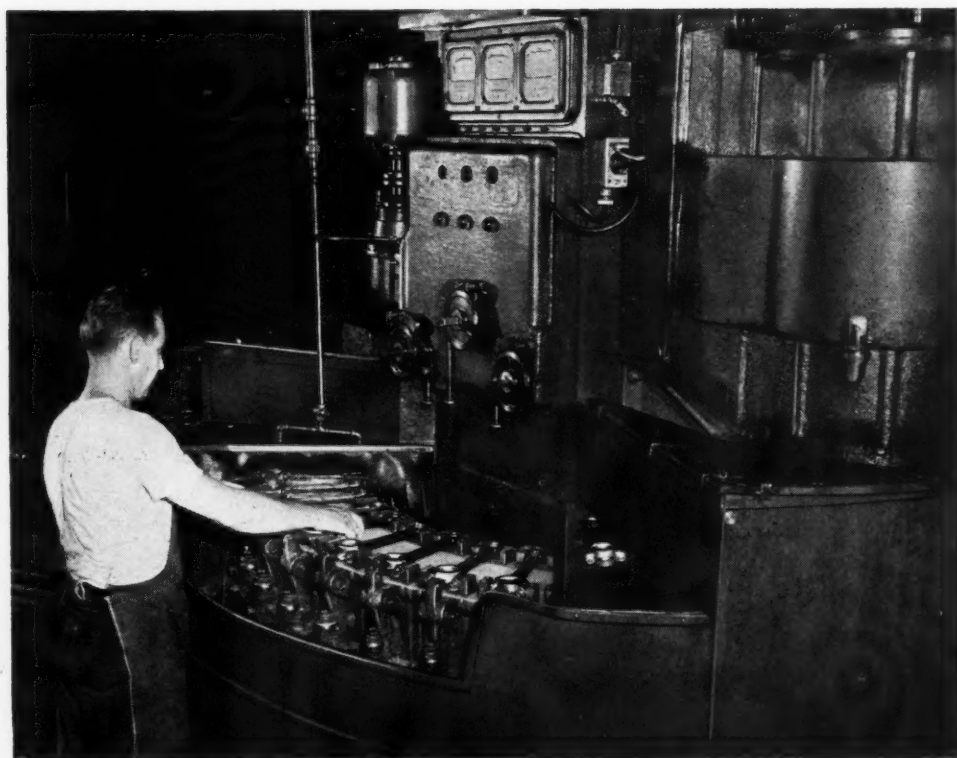


Fig. 7. The Crankpin End and the Piston-pin Holes of Connecting-rod and Cap Assemblies are Bored at the Rate of 330 per Hour on a Six-station Precision Boring Machine

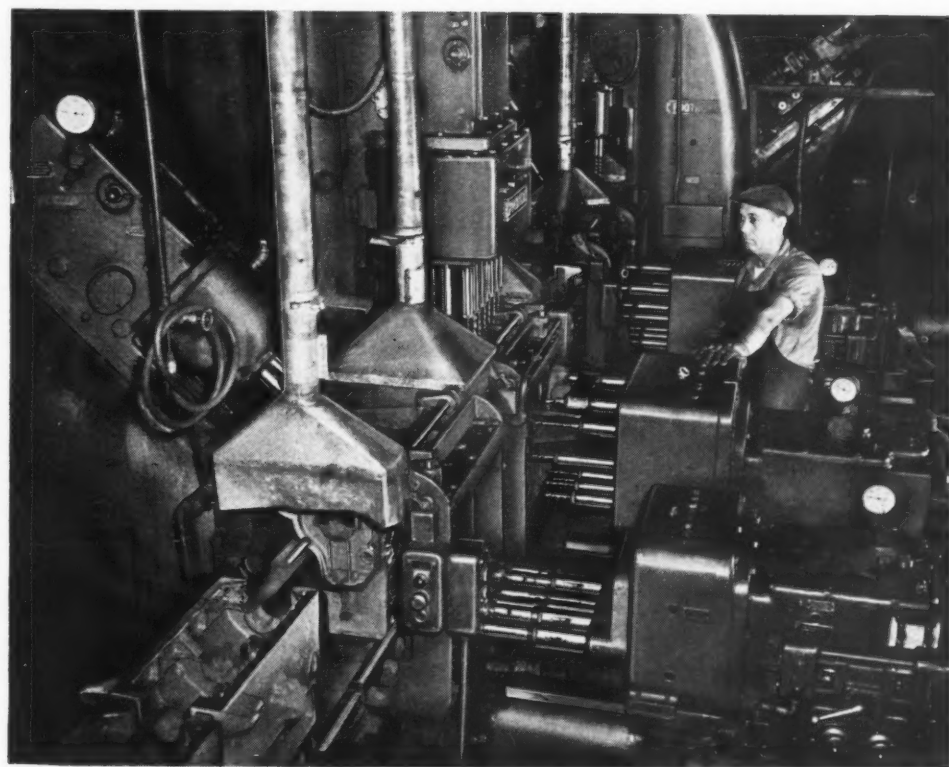
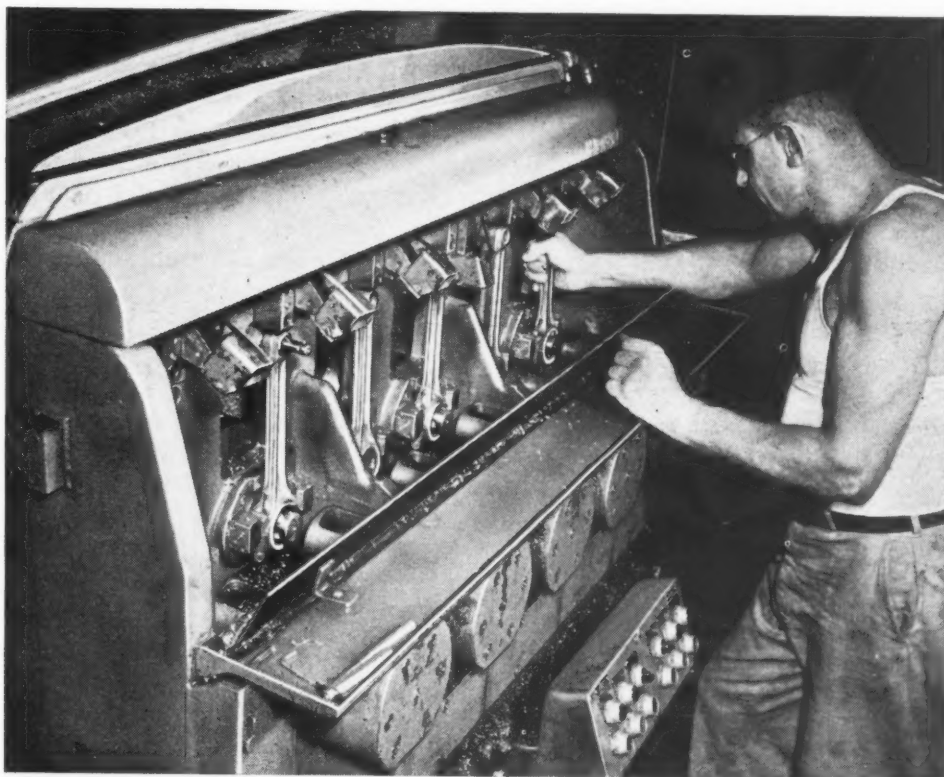


Fig. 8. Ninety-one Spindles are Provided on This Ten-station Transfer Type Machine for Drilling, Counterboring, Chamfering, and Spot-facing the Cylinder Blocks at the Rate of Fifty per Hour

BUILDING THE PEACETIME JEEP

the ratio of one part oil to fifteen parts water, by volume, is used as the cutting fluid.

The bottom and valve side of the cast-iron cylinder block are drilled, counterbored, chamfered, and spot-faced at the rate of fifty blocks per hour on the Foote-Burt transfer type "in-line" machine shown in Fig. 8. Only one operator is required for this ten-station ninety-one-spindle machine. All the tools are rotated at a surface speed of 75 feet per minute.

After loading the blocks manually from a roller conveyor at the first station, each block is automatically transferred from station to station along the 30-foot long machine. At the second station, one suction hole and one discharge hole, 11/32 inch in diameter, are drilled, and two intake and four exhaust port holes, 1 3/8 inches in diameter, are counterbored at the rate of 0.0075 inch per revolution. Eight high-speed steel tools are rotated in two drilling heads—one horizontal and one angular.

A vertical and a horizontal head at the third station contain thirty-six tools for drilling holes for the bearing cap-screws, pan-face screws, and valve-cover bolts, as well as holes in the face of

the manifold, fuel-pump, and oil-pump, and the main oil-line holes. The high-speed steel tools, varying in diameter from 1/4 to 7/16 inch, are fed at the rate of 0.0035 inch per revolution. The fourth station is idle. Twelve tapped holes from 1/8 to 3/8 inch in diameter are chamfered, three 1/4-inch diameter oil-holes are drilled, and one 1/8-inch diameter tapped hole is spot-faced by means of an angular and a horizontal head at the fifth station. These tools are fed at 0.0045 inch per revolution.

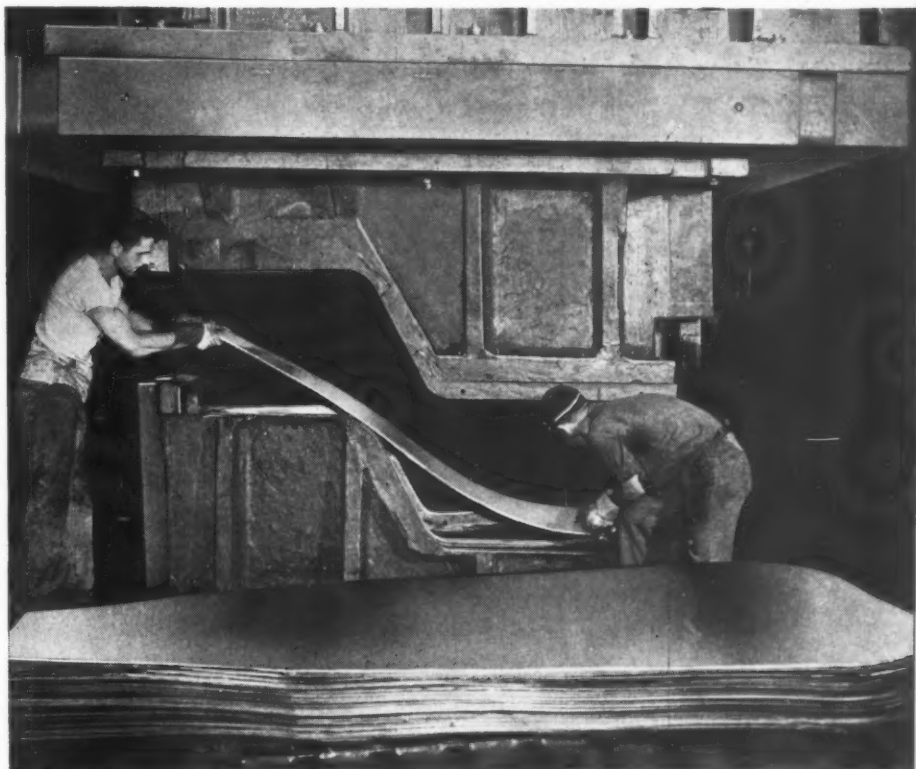
A hole 1/8 inch in diameter is drilled at the bottom of an oil-hole in the rear of the main bearing, two holes 5/16 inch in diameter are drilled in the pan face, and one 7/16-inch diameter hole is drilled for the oil-gage stick at the sixth station. The four drills are held in a horizontal and an angular head and fed at the rate of 0.0035 inch per revolution.

The seventh station is idle, and at the eighth station, a 1/8-inch diameter threaded hole is spot-faced; a discharge hole, also 1/8 inch in diameter, is drilled; and an oil-pump hole 1 1/4 inches in diameter is drilled. The tools are held in a right- and a left-hand angular head, and



Fig. 9. Cast-iron Cylinder Heads are Rough- and Finish-milled on Both Top and Bottom Faces at the Rate of Seventy per Hour on an Eight-spindle Milling Machine

Fig. 10. Fenders are Stamped from 18-gage (0.049 Inch Thick) Sheet Metal Blanks at the Rate of 188 Pairs per Hour on a 1400-ton Triple-action Press



fed at the rate of 0.0045 inch per revolution. Twenty-three tapped holes 5/16 inch in diameter are chamfered, and three holes 11/32 inch in diameter are drilled through the main oil-line at the ninth and final machining station. At the tenth station, the cylinder blocks are unloaded and placed on another roller conveyor.

Bosses on top of the cast-iron cylinder heads, as well as the bottom of the heads, are rough- and finish-milled on the eight-spindle Newton milling machine seen in Fig. 9. Two operators are employed—on opposite sides of the machine—for loading, clamping, unclamping, and reversing or unloading, giving a production of seventy heads per hour completely milled on both sides.

Eight face mills, two left- and two right-hand for both roughing and finishing, are employed. Each cutter is 10 inches in diameter and contains twenty-six blades or tool bits. The Stellite-bladed roughing cutters are rotated at 48 R.P.M., while the finishing cutters, containing

inserted carbide tool bits, are revolved at 22 R.P.M. The work-table rotates at a surface speed of 2 feet per minute.

The castings are clamped manually to fixtures on the rotary table of the machine, twelve castings being held in both the outer and inner circles. About 3/16 inch of stock is removed from the top and bottom of the heads in the roughing operations, and 1/16 inch in finishing. Parallelism between the two faces of the cylinder head is maintained within ± 0.001 inch.

The press shop, seen in the heading illustration, has been expanded since the war at a cost of \$5,000,000, to produce stampings for 500 bodies a day. Running beneath twenty of the presses in this shop is a 600-foot conveyor which carries scrap from the presses to a baling machine. Fenders are stamped from 18-gage (0.049 inch thick) sheet metal at the rate of 188 pairs per hour on the Clearing 1400-ton triple-action press seen in Fig. 10.

Outstanding Operations in Producing Kaiser-Frazer Steering Assemblies

Some Unusual Machining, Inspecting, and Finishing Operations Performed at the Huge Willow Run Plant in Producing Nine Hundred Steering Assemblies per Day

By JOHN J. SHEPP
General Superintendent of Machining
Kaiser-Frazer Corporation
Willow Run, Mich.

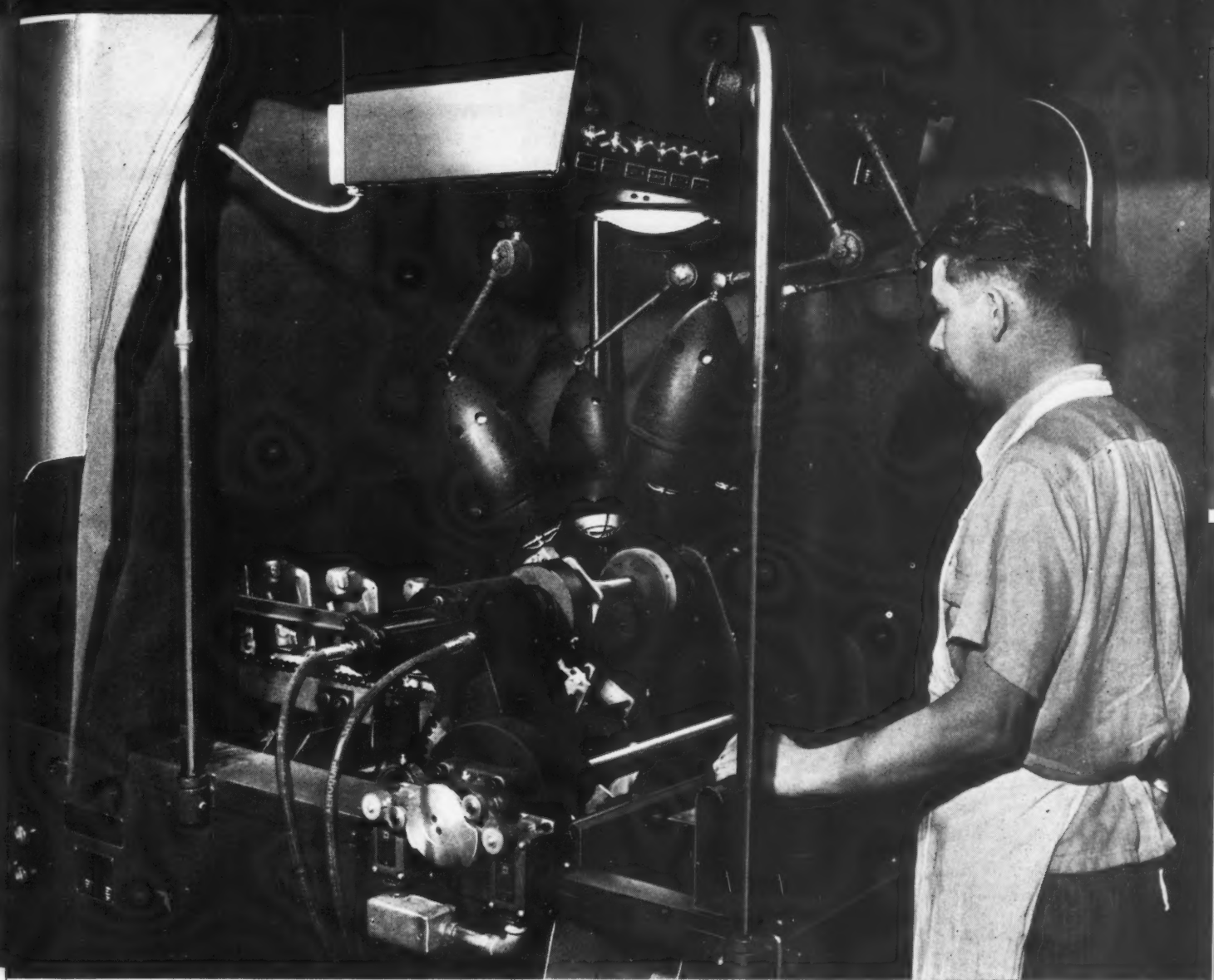
EASE in handling Kaiser and Frazer automobiles is attributed by the manufacturer to the "Truline" steering assemblies used on these cars. During the past year, more than \$250,000 has been invested in tools and equipment to make parts for these assemblies. Under license from the Gemmer Mfg. Co., of Detroit, approximately nine hundred of the new three-tooth steering units are being produced daily at the Willow Run plant.

Blanks for the worms of steering-gear assemblies are turned, faced, drilled, and cut off from SAE 5130 chromium-steel bar stock in multiple-spindle automatic screw machines. After broaching a keyway in the bore of the blank on a Colonial 6-ton, 36-inch stroke vertical broaching machine, the part is pressed on an arbor, which

is held between centers on a Sundstrand automatic lathe, Fig. 1.

This special lathe is equipped with four slides located in an angular position relative to the work axis for simultaneously finish-forming the conical-shaped bearing seats and under-cutting a relief on both ends of the steering-gear worms. The two front slides support the tool-blocks holding the under-cutting tools, while the two rear slides carry the high-speed steel circular form tools that finish-form the cones.

A cutting speed of 45 surface feet per minute is employed, and the tools are fed at the rate of 0.002 inch per revolution removing about 0.015 inch of stock. Upon the completion of the cut, the cam-operated slides are returned rapidly by means of die springs. On this operation, a pro-



duction of 90 parts per hour is obtained. Soluble oil, in the ratio of one part to ten parts of water, is used as the cutting fluid.

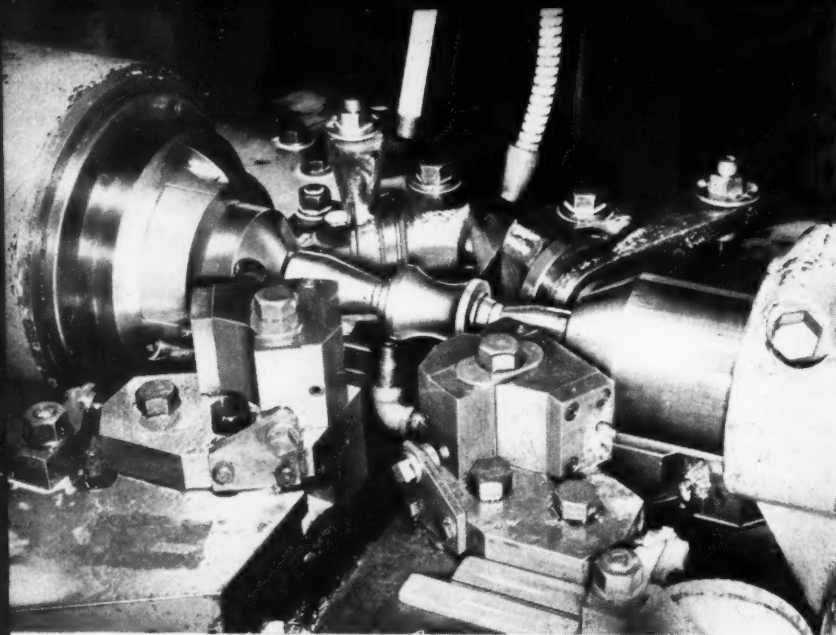
The life of the high-speed steel form cutters used in this operation has been increased as much as 300 per cent (an average of 200 per cent) by subjecting the tools to a low-temperature nitriding process. The treatment, which is applied after the tools have been hardened and ground, consists of immersing the finished tool for a short period of time in a nitrogen-rich salt bath maintained at a temperature of 1020 to 1050 degrees F.

Case depths depend upon the length of immersion. The tempering (drawing) is repeated three times, the tool being cooled to room temperature between each heating cycle. With a ten- to fifteen-minute treatment, a case depth of 0.001 to 0.003 inch is obtained. Although there is very little increase in hardness, the toughness and wear resistance of the tools are greater. After several sharpenings, the tools can be retreated to build up the case depths.

In "Truline" steering assemblies, a three-

tooth, 104-degree worm replaces the more common two-tooth, 84-degree worm. The teeth are cut in one roughing and one finishing operation on special Fellows thread generators, Fig. 2. Helical type, twenty-tooth cutters, located on spindles at right angles to the axis of the part, are rotated at 25 R.P.M. for both roughing and finishing cuts, and fed at an average rate of 0.0125 inch per revolution for roughing and 0.0022 inch for finishing. The work is rotated at 475 R.P.M., corresponding to a maximum surface speed of 230 feet per minute. A 10 to 1 solution of soluble oil is used for this operation also. A production of 52 worms per hour is obtained in roughing, and 112 per hour in finishing.

After removing the sharp edges at the ends of the threads on a Blount speed lathe, the threads are checked by means of a master roll on a Fellows "Red Liner" inspection machine. The master is flexibly mounted, so that any errors in the worm being tested affect the center distance between worm and master. Movements of the master are transferred to a pen, which



PRODUCING "TRULINE"

traces a red line on a constantly moving chart.

Next, the worms are degreased to remove the coolant and casehardened by liquid cyaniding. In this process, cyanide salt is maintained at a temperature of 1500 degrees F. in an Ajax 50-kilowatt electric furnace. After being immersed in the cyanide bath for twenty to thirty-five minutes (depending on the number of parts being treated) a 0.006- to 0.008-inch case is imparted to the worms.

The heated parts are immediately quenched in oil, which is maintained at a temperature of 125 degrees F., and then washed with boiling water containing an alkaline cleaner to remove the cyanide. A surface hardness of from 57 to 60 Rockwell C results from tempering the parts for three hours at 400 degrees F. After another wash, the parts are ready for assembly.

Steering-gear pitman arms are made from S A E 1045 steel forgings. The roughly formed ball on one end of each arm is turned to size by means of a carbide-tipped form tool mounted on a Warner & Swasey turret lathe, Fig. 3. The complex forging is held in the air-operated chuck by means of special jaws. A cutting speed of 245 feet per minute is employed, and the tool is fed at the rate of 0.002 inch per revolution to obtain a production of eighty-seven per hour. A "Go"- "No Go" snap gage,



Fig. 1. (Top) Blanks for the Worms of Steering-gear Assemblies are Simultaneously Finish-formed and Under-cut on an Automatic Lathe

Fig. 2. (Center) Teeth are Cut in the Worm Blanks on a Special Thread Generator

Fig. 3. (Bottom) A Ball-turning Operation is Performed on One End of the Pitman Arm with a Form Tool Mounted on the Cross-slide of a Turret Lathe. Special Chuck Jaws Hold the Forging



STEERING ASSEMBLIES

shown mounted on front of the cross-slide, is used to maintain the ball diameter within ± 0.0005 inch of the desired size.

The opposite, or hub end, of the pitman arm is drilled and chamfered, after which serrations are broached in its bore. A high-speed steel serrated swage punch, mounted on the stationary bed of a Bliss punch press, Fig. 4, is used to form a taper of 0.750 inch per foot in the bore of the part. The bore of the pitman arm is forced over the punch as the ram descends. A spherical washer is provided under the punch to take care of any misalignment, since the faces of the part are simply coined and not accurately machined. A production of 435 per hour is attained in this swaging operation.

After degreasing to remove the drawing compound used in the taper swaging operation, the ball ends of the pitman arms are induction-hardened by means of the Tocco machine shown in Fig. 5. A hardness of 55 to 60 Rockwell C, extending to a depth of about $1/8$ inch, is obtained in a closely controlled pattern. The ball is heated to about 1600 degrees F. in seven seconds, and then quenched by a water spray for four seconds. The production rate is 240 per hour.

Front-end steering knuckles, forged from SAE 8640 nickel-chromium steel, and other critical forgings of the steering assembly are automatically inspected, before machining, on a special Magnaflux unit shown in the heading illustration. The parts are loaded manually on the conveyor stations, but are not touched again until they have been accepted or rejected. The intermittently moving conveyor progressively

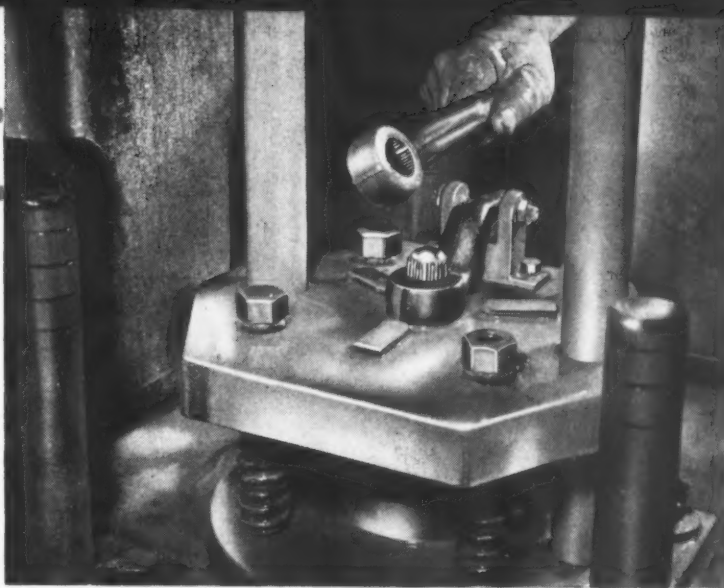


Fig. 4. (Top) A Taper is Formed in the Bore of the Pitman Arm by Means of a Serrated Swage Punch Mounted on a Punch Press

Fig. 5. (Center) Induction Hardening of the Ball End on the Pitman Arms. A Hardness of from 55 to 60 Rockwell C is Attained in a Seven-second Heating and Four-second Quenching Cycle

Fig. 6. (Bottom) Hydraulically Operated, Cam-actuated Swiveling Fixture that Permits Unloading a Completed Knuckle and Loading a Forging while a Second One is being Broached

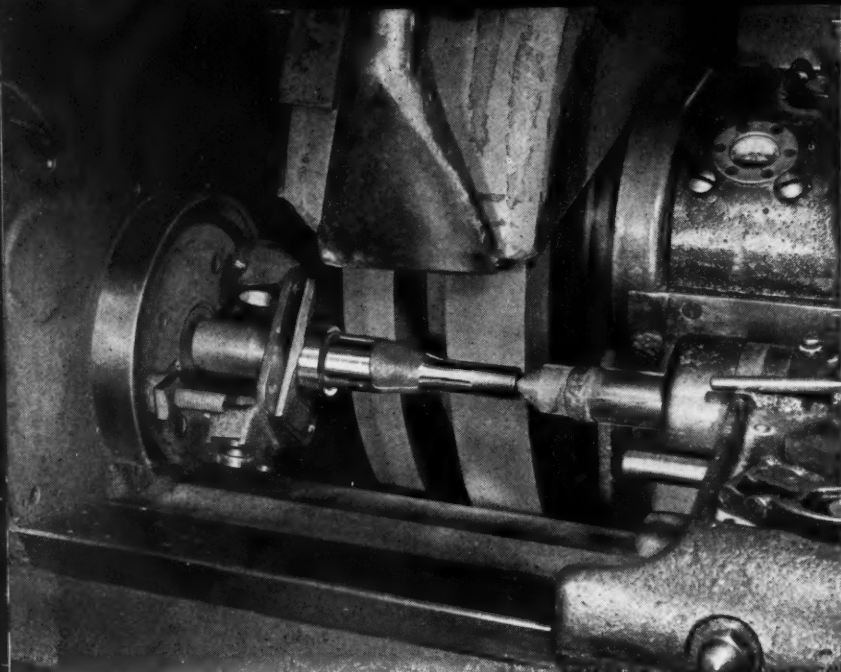


Fig. 7. Both Bearing Seats on the Steering Knuckles are Simultaneously Finished on a Dual-wheel Grinding Machine

positions each part between heads, where it is clamped. A current of high amperage and low voltage is passed between the heads to establish magnetic fields in the work. The part then passes through a bath of "Magnaglo," a special Magnaflux paste mixed with oil to form a suspension of ferro-magnetic particles.

Sudden interruptions of the magnetic field induced in the part, caused by a crack, lap, or other defect in the forging, attract and hold the ferro-magnetic particles, thus forming definite indications of the location, extent, and shape of the defect. Parts so treated are mechanically clamped between rubber-faced heads, picked off the conveyor, and rotated in a darkened enclosure under "black light" illumination. "Black light" is a term popularly applied to the invisible radiant energy in that portion of the ultra-violet spectrum just beyond the blue of visible lights.

Indications, caused by the accumulation of ferro-magnetic particles, appear under black light as bright greenish-yellow fluorescent lines.

If such indications appear, an inspector, seated in the darkened enclosure, taps a switch which automatically dumps the part into a salvage stock bin. If no defects are evident, another switch is actuated to slide the parts through a demagnetizing coil and into tote boxes for transfer to the first machining operations.

Jigs on each conveyor station are designed to take any of the various-shaped parts with a minimum of adjustment between runs of one part or another. Rate of inspection is variable from 0 to more than 1200 parts per hour by means of a variable-speed conveyor drive.

Rejected parts are chipped, ground, or machined at the points where defects are indicated, for reinspection. If the defect is removable within the stock allowances specified, the part is demagnetized and used.

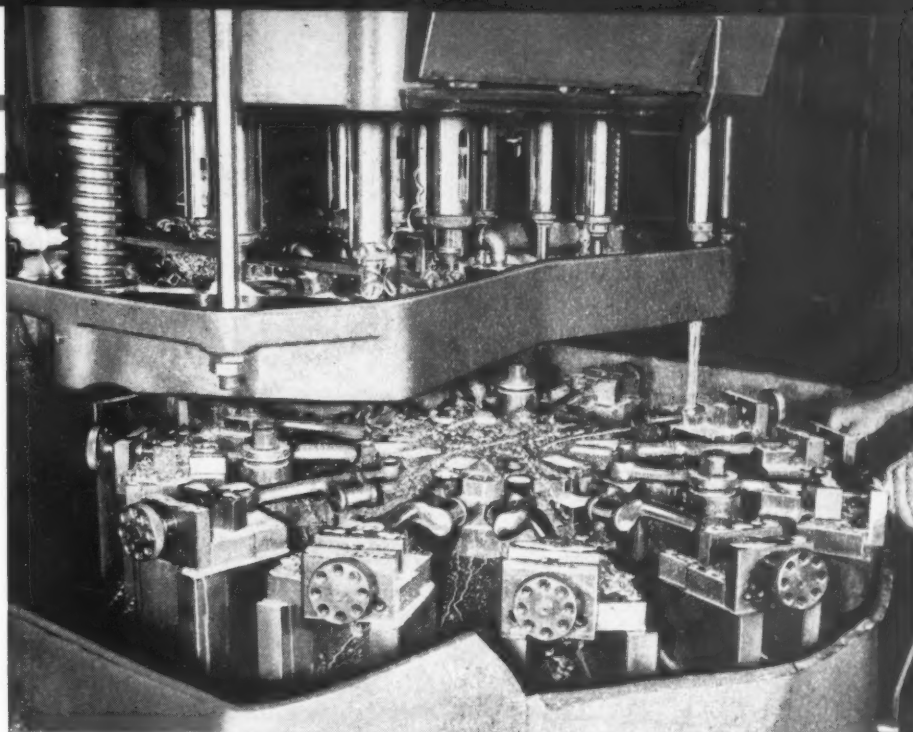
Front-end steering knuckles are straddle-broached on a Foote-Burt dual-ram, 15-ton vertical broaching machine. About 3/16 inch of stock is removed from four surfaces parallel and



Fig. 8. King-pin Holes in Steering Knuckles are "Bearingized" to Obtain a Smooth, Hard Surface Having Good Lubricating Qualities

STEERING ASSEMBLIES

Fig. 9. Two Holes are Drilled and Reamed in Each Steering-knuckle Support on a Sixteen-spindle Machine. One Hundred Twenty Parts are Produced an Hour



perpendicular to each other in the same plane. Each ram broaches two surfaces.

The broaches are fed downward hydraulically at the rate of 20 feet per minute, and approximately 0.003 inch of stock is removed per tooth. A tolerance of ± 0.0015 inch is maintained. Two men operate the machine, one at each station, and 180 knuckles are broached per hour. Soluble oil in the ratio of one part of oil to seven parts of water is used as a coolant.

Both ears on the steering knuckle are straddle-broached simultaneously on a 25-ton Oilgear dual-ram broaching machine. A hydraulically operated, cam-actuated swiveling fixture, Fig. 6, permits loading and unloading one knuckle while a second one is being broached.

After drilling, reaming, and counterboring the king-pin holes, the bearing seats of the knuckles are ground on the Norton dual-wheel grinding machine shown in Fig. 7. Approximately 0.015 inch of stock is removed from each of the two bearing seat diameters, at the rate of 55 knuckles per hour. The two grinding wheels, 24 inches in diameter by 1 1/2 and 2 inches wide, are rotated at 925 R.P.M. The work is revolved at 6000 surface feet per minute. An emulsion containing one part of soluble oil to fifty parts of water is employed as a cutting fluid. The tolerance on bearing seat diameters is ± 0.0002 inch.

To obtain a smooth, hard surface with good lubricating qualities for use with a floating bearing, the king-pin holes in the steering knuckles are "Bearingized" on the Cogsdill "Bearingizing" machine shown in Fig. 8. This

operation produces a finish similar to burnishing by the use of a tool having cam-operated rolls that apply both blows and pressure to the surface of the work.

Accuracy of the bores produced in preparatory operations is of great importance in controlling the size of the holes that are "Bearingized." The broaching tools used for preliminary sizing of the king-pin holes are matched with the "Bearingizing" tools. The steering knuckle is placed in a fixture, and reciprocated by hand over the "Bearingizing" tool, which is rotated at 535 surface feet per minute. No metal is removed, but the bore diameter is increased from 0.0003 to 0.0007 inch, and a surface finish of from 4 to 12 micro-inches r.m.s. is obtained, depending upon the size and finish of the broached holes. The production rate for this operation is 294 per hour.

Steering-knuckle supports, also forged from SAE 8640 steel, are drilled and reamed on the sixteen-spindle Baush hydraulic drilling machine seen in Fig. 9. Eight high-speed steel drills and eight reamers are mounted on the multiple drilling head. With this equipment, four supports (two right-hand and two left-hand) are completed per cycle. The 29/32- and 1 3/32-inch diameter drills are rotated at 42.75 surface feet per minute and fed at the rate of 0.006 to 0.007 inch per revolution. The reamers revolve at 110 to 130 surface feet per minute, and are hydraulically fed at 0.0015 inch per revolution. One hundred and twenty supports are completed per hour. By using heavy-duty, thick-web twist drills, drill life has been increased 300 per cent.



ONE of the largest and most completely automatic copper-nickel-chromium electroplating installations in the world is now in operation at the plant of the Pontiac Motor Division of the General Motors Corporation, Pontiac, Mich. This installation has a capacity for plating 19,000 steel stampings of nineteen basic types every sixteen hours, which is equivalent to 20,000 square feet of plated surface.

The plating tanks are arranged in a single line, divided into three sections. The first section, which is used for copper plating, is 207 feet long. Fifteen automatic operations are completed in sixty minutes in this section. The main copper-plating tank contains 58,000 gallons of solution, which is circulated constantly at the rate of 1500 gallons per minute. The solution is filtered at the rate of 1260 gallons per minute. The circulating system passes the solution through sixteen heat exchangers to maintain a constant temperature of 170 degrees F.

The parts traverse the tanks in three lines on 8-foot racks suspended from horizontal bars.

These bars are spaced 30 inches apart and move along tracks on each side of the tanks. A cog chain in the tracks propels the loaded bars. The tracks are arranged to lift the work load out of one tank and lower it into the next. The solution tanks are 12 feet wide by 9 feet deep, and are set in pits 18 feet wide by 5 feet deep.

The second section of the installation, where nickel plating is done, is 250 feet long and includes fourteen different tanks. The operations performed here require seventy-five minutes for a complete cycle. The nickel-plating tank holds 67,200 gallons of solution, or the equivalent of the capacity of eight and one-half tank cars. This solution is also filtered, and a constant temperature is maintained through fifteen heat exchangers.

The final, or chromium-plating, section is 139 feet long. At this point, there are only two lines of work traversing the tanks, instead of three. Ten operations are performed in the chromium section. The main solution tank has a capacity of 15,700 gallons; by having it divided into two compartments, it is possible to operate the two

Electroplating Methods Used in One of the World's Largest Installations

Nineteen Thousand Parts of Nineteen Basic Types are Copper-, Nickel-, and Chromium-Plated Every Sixteen Hours by This Recent Electroplating Installation, which Includes Plating and Rinsing Tanks Having a Total Capacity of 500,000 Gallons—Equivalent to that of Fifty-Five Tank Railway Cars

lines of work at different cathode current densities.

Adjacent to each plating section are storage tanks into which the copper, nickel, and chromium solutions can be pumped when the main tanks require maintenance work. These storage units will accommodate over 158,000 gallons, which brings the total capacity of all tanks in the system to about 500,000 gallons—equal to the capacity of fifty-five tank cars. Ventilation of all tanks is provided by thirty-two blowers having a capacity of 434,000 cubic feet of air per minute. Soft water for the installation is supplied at the rate of more than 50 gallons per minute by a system of anion and cation demineralizer tanks and aerators, which reduces

the mineral content of the water to less than twenty parts per million. A dual system permits regeneration when required.

Parts handled by the plating equipment include radiator grille blades, center decorating strips for hoods, bumper guards, and occasionally some service parts for earlier models. Most of the parts are of cold-rolled steel, about No. 22 gage. Some pieces are polished before the initial copper plating. All parts are buffed after copper plating. Long lines of both automatic and hand buffing machines adjoin the plating line, and conveyor lines carry the parts to the buffing machines from the discharge end of the copper-plating tanks. This is effected by means of an ingenious transfer system. After buffing,



ELECTROPLATING

A Conveyor Line Brings Parts to be Plated from the Stamping Department to Conveyorized Automatic Polishing and Buffing Machines for Producing a Hard Surface Finish prior to the Electroplating Operations

the parts are again placed on racks for nickel and chromium plating.

Specifications call for copper-plating to a depth of 0.001 inch. As buffing removes about 0.0002 inch of this layer, this plating is replaced by a copper strike in the nickel-plating section. Nickel is deposited to a thickness of 0.0005 to 0.0008 inch. The final chromium plate is, of course, only a flash layer.

The sequence of operations in copper plating is as follows:

(1) Power wash in slot type chambers with vertical rows of spray nozzles discharging alkaline solution at the rate of 1500 gallons per minute. The solution is recirculated, a sump tank being provided to replenish solution and take off oil and grease. (2) Hot water rinse. (3) Dip

in alkaline electrocleaner solution held at a temperature of 190 degrees F. (4) Water rinse. Rows of spray nozzles are positioned to direct streams on the parts as they are raised from the tank. The sprays shut off automatically as the rack of parts clears the top of the tank. (5) Acid dip. (6) Water rinse. (7) Water rinse again. (8) Cyanide copper strike. (9) Water rinse. (10) Acid dip. (11) Water rinse. (12) Copper plate (du Pont system) in the main tank. Six rows of anodes flank the three lines of parts. The solution is turned over twice an hour or the entire tank may be pumped out in one hour. (13) Lower work into "drag-out" tank to conserve copper-plating solution. (14) Cold water rinse, and (15) Hot water rinse.

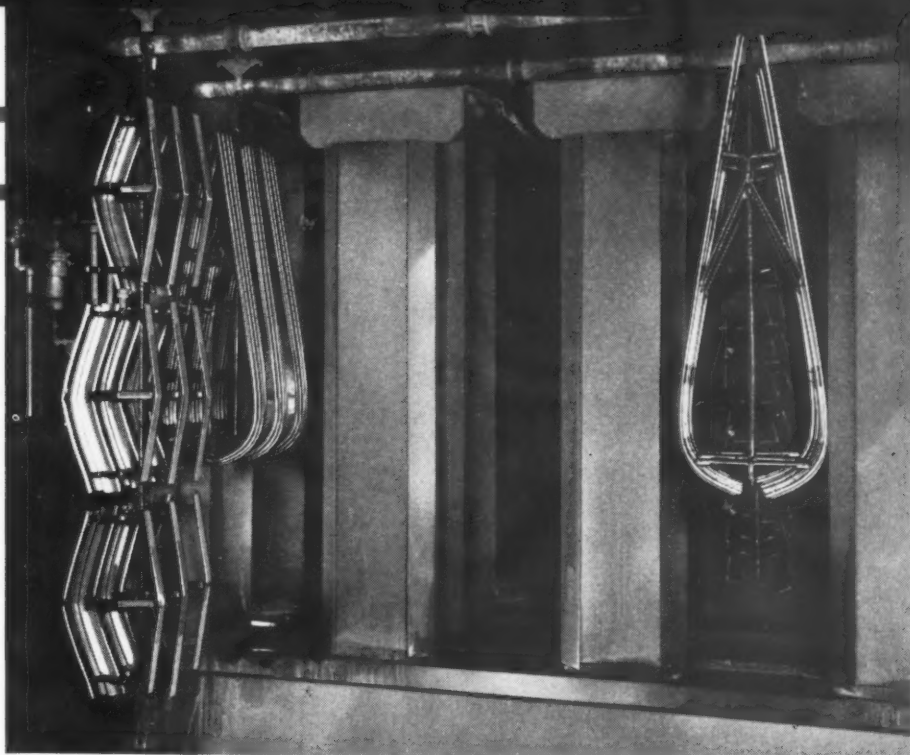
The sequence in nickel plating is as follows:



Following the Automatic Buffing Operations, the Parts are Polished by Hand on Two-wheel Floor-stand Machines

METHODS

As the Polished Stampings Enter the Electroplating System, They First Pass through a Washing Unit, where They are Subjected to a Series of Forced Sprays, and Then Proceed through Cleaning and Rinsing Tanks



(1) Soak in alkaline solution. (2) Power wash in chambers similar to copper section. (3) Dip in alkaline electrocleaner. (4) Water rinse. (5) Copper strike. (6) Water rinse. (7) Acid dip. (8) Water rinse. (9) Copper-plate (Unichrome process) in 27-foot tank, (containing 23,500 gallons) operated at somewhat lower temperature than original copper-plating. Thickness applied about 0.0002 inch. (10) Cold water rinse. (11) Cold water rinse (de-ionized water). (12) Bright nickel-plate in solution held at a temperature of 140 degrees F. (McGean). An auxiliary 1150-gallon electrolytic purification tank keeps the nickel solution pure. The purification tank is about 4 by 15 feet in size, loaded with about 250 nickel anodes and operated at low current density to remove all

metallic impurities in the solution circulated through it. (13) Cold water rinse, and (14) Hot water rinse.

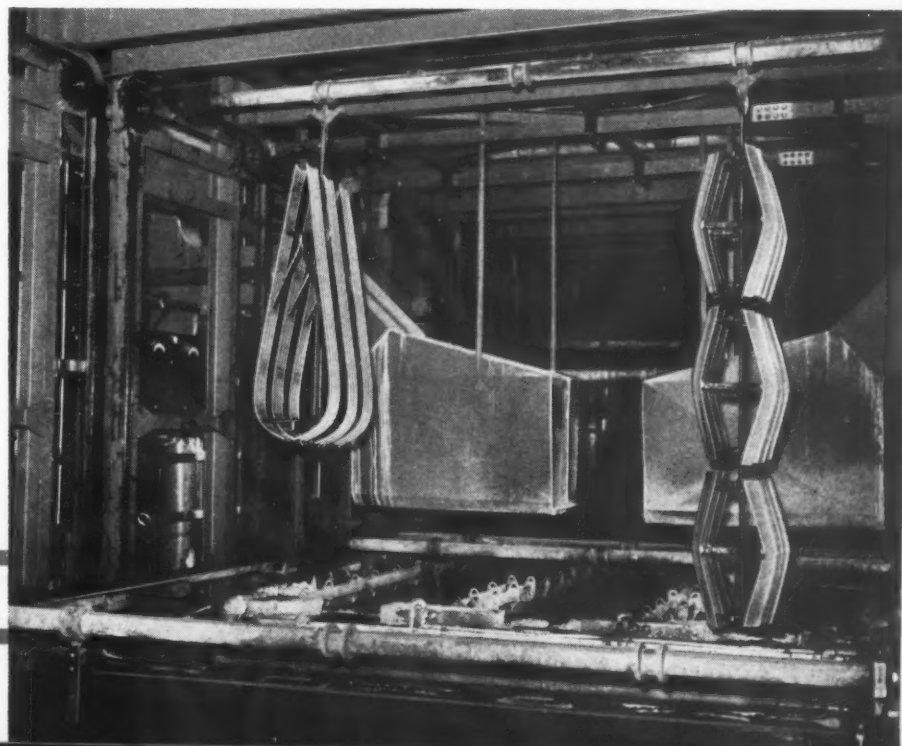
The sequence of operations in applying the chromium flash is as follows:

(1) Power wash as before. (2) Dip in alkaline electrocleaner. (3) Water rinse. (4) Acid dip. (5) Water rinse. (6) Water rinse again. (7) Chromium-plate. (8) Spray rinse. (9) Water rinse, and (10) Final water rinse.

Following inspection and minor touching up of "burned ends" or other blemishes, the parts are routed to assembly points.

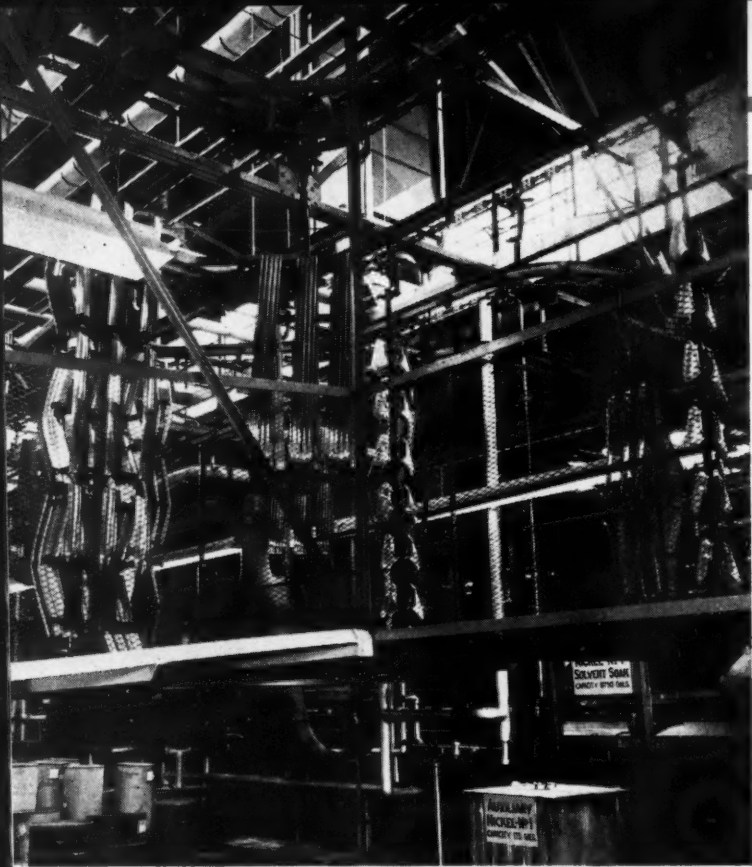
Although a minimum of operators is required for this large plating installation, special safety precautions have been taken throughout. A catwalk extends the full length of each of the three

Entire Plating Operation is Automatic, Parts being Transferred from Tank to Tank and Immersed by a Conveyor



ELECTROPLATING METHODS

General View of the Electroplating System, Showing Parts Moving along the Chromium-plating Section



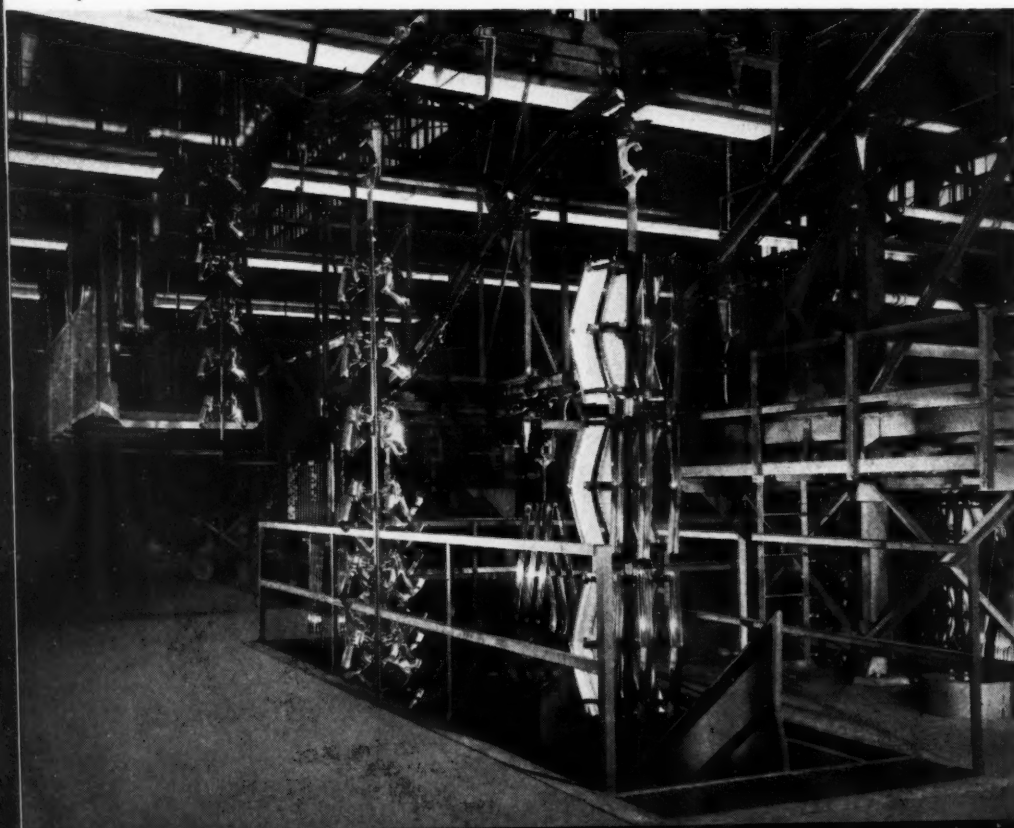
sections of the plating line, slightly above the level of the tank tops. Along this walk is a control cord which, when depressed by an operator, stops the entire line. At six other points in the installation, there are also emergency stop controls. The moment one of the controls is actuated, a light flashes on a signal board to show what station occasioned the stop. Only when this station is clear again can the line be started, and then only by an operator at a master control panel at the beginning of the line. When he sees that the trouble light in question is "off,"

he sounds a warning horn for thirty seconds, after which he may start the conveyor line.

All major plating tanks are rubber-lined, and the chromium tank is both lead- and brick-lined. To prevent damage from falling parts, all the tanks are covered with loose brick. The heated tanks have automatic heat controls, while the rinse tanks have level controls.

Direct current for the installation is supplied by twenty-two motor-generator sets ranging in capacity from 5000 to 15,000 amperes. The total generator capacity is 285,000 amperes. Current of 2 to 3 volts is supplied to the copper-plating solution and of 6 to 7 volts to the nickel-chromium-plating tanks.

The plating racks are coated with a thermo-setting vinyl plastic, there being a special department for rack maintenance. After being dipped into a primer coat and a finish coat, the racks are passed through a small oven lined with infra-red lamps that produce a temperature of 350 degrees F., at which temperature the plastic sets. The same material is used to touch up racks that may have developed bare spots. Experience has proved the plastic coating to be much more satisfactory than the rubber coating that was formerly employed.



Completely Electroplated Parts being Raised to the Floor above from Tanks in the Electroplating Installation. The Total Capacity of All Tanks in This System is One-half Million Gallons of Plating Solution and Rinsing Water

Production Experts Needed in ECA

NO nation can be prosperous unless its people are highly productive of goods that can be sold in national and world-wide markets. The more the people can produce, the more prosperous the nation is as a whole. This has been the foundation of the prosperity of the United States, and is the thesis on which the Marshall Plan was based in the effort to get the nations of Europe back on their feet in the economic world.

Sincere efforts are being made by Paul G. Hoffman and his associates in the Economic Cooperation Administration to get the beneficiaries of the Marshall Plan to realize that their economic comeback depends upon expansion of their productivity and that this can be accomplished only through the use of modern machinery in their industries.

But the politicians in some of the countries are loath to recommend money for this purpose from their ECA allocations. They want to spend the money in providing necessities such as food and clothing to their individual constituents in the selfish hope of gaining votes that will retain them in political office. Of course, there are also Communist politicians who do not want the Marshall Plan to succeed, and who are therefore exerting every effort to divert funds from channels that would improve the economic status of their country.

Unless this situation is remedied, great danger exists that the Marshall Plan will degenerate into a gigantic relief program and that the original objectives will not be attained. It is safe to forecast that should this occur, Congress will not long continue to appropriate the billions of dollars required annually by the nations who have agreed to cooperate.

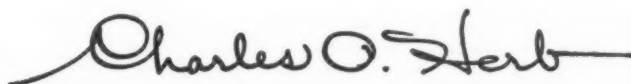
Over \$100,000,000 worth of American machine tools have already been requested by European manufacturers—orders have actually been prepared and placed with suppliers' agents. However,

because the local politicians who have authority to allocate the Marshall Plan funds will not allot money for the purchase of such equipment, the manufacturers are compelled to get along with obsolete worn-out equipment and operate at low productivity.

American production men who recently made a study of the situation in visits to the various countries feel that ECA should have high on its staff in Washington a man closely identified with the manufacturers of metal-working equipment, who could keep before the eyes of the European statesmen a picture of high productivity attained through the use of modern manufacturing equipment. This man should be familiar with the latest types of machine tools, welding apparatus, mechanical and hydraulic presses, and so on. Such a man could be of immeasurable help in steering ECA and the participating countries toward achieving the objectives of the Marshall Plan.

In fact, every branch of ECA abroad should have on its staff a man possessing wide knowledge of production equipment. There seems to be a tendency to select mostly bankers and lawyers for government agencies on the theory that their business and legal training will suffice. Unfortunately, when it comes to manufacturing processes, men of this training are beyond their depth. For instance, much time has been lost by the insistence of bankers and lawyers in ECA that European manufacturers find what they need from the war surplus machines in the United States. Wild-goose chases have resulted.

If a European manufacturer wants to buy an American machine tool, that means he is willing to pay about twice as much as European built equipment would cost. It should be the business of ECA to do everything possible to clear the road so that the preferred machine tool can be purchased.



EDITOR

Engineering News

X-Ray Measurement of Strain in Metal

It is possible to measure the interatomic spacing of crystals by means of X-ray diffraction. Because a crystal becomes deformed under applied stress, with a resultant change in the interatomic spacing, X-ray diffraction can be utilized to determine the magnitude of strain in the crystal. Comprehensive investigations by the Metallurgy Division of the National Bureau of Standards in the field of X-ray strain measurements have been directed toward improving the sensitivity and precision of this method of determining strain in metals.

Results obtained by irradiating a flat steel specimen under tensile stress are plotted against surface strain values measured with wire strain gages to obtain a calibration curve. An X-ray beam, emerging through a pin-hole at the center of a circular film-holder, is diffracted by the crystals of the metal specimen mounted in front of the film-holder. The diffracted X-ray beam is recorded on a film located behind aluminum foil in a holder. Measurement of the diffraction rings thus recorded permits the strain in the specimen to be determined.

Titanium Metal Now Manufactured for Industrial Development

Small-scale manufacture of titanium metal—a new basic raw material for industrial development—has been started by E. I. du Pont de Nemours & Co., Inc. A pilot unit of 100 pounds daily capacity has been placed in operation at the Newport, Del., plant of the pigments department. This is the first time ductile titanium metal has been made for commercial use.

The silver-white metal is light and strong, being comparable to stainless steel in strength and corrosion resistance, although it weighs only a little more than half as much per unit of volume. Reports of the U. S. Bureau of Mines indicate that it can be used where a high ratio of strength to weight is required, as in high-speed aircraft and other forms of transportation. It may also be used in corrosion-resistant equipment, printing presses and textile machines.

Automatic Gun with Radar Control Developed by U. S. Navy

According to *Ordnance*, the Journal of the American Ordnance Association, the Navy has designed a 3-inch twin automatic gun that may be the answer, in part, to the missiles of the future. It will be equipped with a revolutionary radar fire-control system, by which the mount automatically picks up any enemy aircraft or missile, tracks it, computes all necessary corrections for windage, temperature, and similar factors, and opens fire at effective range.

Friction Discounted as a Major Cause of Automobile Engine Wear

In tests conducted by the Shell Oil Co., Inc., it was found that friction is not the main cause of automobile engine wear. Up to 90 per cent of engine wear is caused by the chemical attack of partially burned gases and moisture on polished metal surfaces. This acid action results from incomplete combustion, caused by the low operating temperatures that exist on very short trips, when an automobile engine is intermittently on and off. Laboratory tests were made, using special one-cylinder engines and regular model automobile engines, as well as apparatus for determining the properties of motor oil. All tests conducted in the laboratory were supplemented by road tests.

Steam Pipe for Hottest Turbine will Run Dull Red

Steam at a pressure of 1500 pounds per square inch and a temperature of 1050 degrees F. is required to feed a 100,000-kilowatt turbine recently shipped by the Westinghouse Electric Corporation for installation in one of the generating stations of the Public Service Electric & Gas Co. of New Jersey. With such a high temperature and pressure, the steam pipes will glow a dull red. To withstand operating conditions in the dull red region, throttle valves, steam chests, and other high-pressure parts of the turbine are constructed of stainless steel.

Machine Tool Builders Study Problems of National Security and European Sales

PROBLEMS arising from the program of the National Security Resources Board as they affect the machine tool industry and difficulties encountered in the endeavor to supply production equipment to European nations under the provisions of the Marshall Plan received the attention of the National Machine Tool Builders' Association at the forty-seventh annual meeting of that organization held in Atlantic City October 18 to 20, inclusive.

In his opening address, A. G. Bryant, president of the Association, indicated that in the event of a war emergency, the machine tool industry could not attain the rate of operations required to insure prompt industrial mobilization within much less than six months' time. Pointing out that the program of the National Security Resources Board calls for the building of 100,000 machine tools within twelve months following such an emergency, Mr. Bryant expressed the opinion that advance notice of the task committed to them has great value to manufacturers, but would be an empty gesture unless the program could be promptly and adequately carried out.

Said Mr. Bryant: "The American machine tool industry has, since the peak of the wartime

production rate, reduced its capacity to one-third of the maximum, and yet has been operating for over two years at a level of only about one-half of its reduced capacity. The industry first suffered from the smothering effect of the absorption of its post-war market by the disposal of war surplus machines. Then its sales were restricted by the effect of unsound taxation policies and unwise depreciation practices upon its customers. Now for over a year, one-fifth of its volume, which for decades has customarily been shipped abroad, has been taken away by the influence of the dollar shortage in foreign countries.

"Machine tool builders have had to let their working forces dwindle, and there are no available reserves of skilled workmen that could be immediately tapped for a rebuilding of working shifts to a basis of normal operations. Supplies of steel, castings, scrap, pig iron, and other essentials are so scanty that months would be required to get machine tool production in the average plant on a satisfactory basis in an emergency. Engineering staffs have been decreased not only because competent men are unavailable, but also because of the drastically reduced basis of operations. Machine tool com-



Photo Whitney

Newly Elected Officers of the National Machine Tool Builders' Association. (Left to Right) President, Lloyd D. McDonald; First Vice-president, David Ayr; and Second Vice-president, Richard E. LeBlond

panies cannot afford to support research and engineering development at the right level.

"The industry does not believe in subsidies or artificial stimulants. It wants no help that is not justified by its own services. It asks simply that America and the world recognize that the maintenance of a dynamic machine tool industry is of crucial importance to all people."

Mr. Bryant outlined the following five-point program for the machine tool industry:

1. *Engineering Development*—The American machine tool industry must be able and willing to continue its research and engineering development calculated to keep its products continuously in a position of supremacy.

2. *National Defense*—For the security of our nation, the industry must continue unstintingly to render such advisory assistance to the armed forces as will keep our facilities for the production of defense materiel in a condition of maximum usefulness and dependability.

3. *Effective Selling*—It must sell "the world's best investment"—machine tools—as the machines that will provide more goods for more people at lower cost.

4. *Fiscal Policies*—As an essential to the maintenance of a high standard of living, it must vigorously urge the enactment and enforcement of such sound policies of taxation, repricing, and amortization as will encourage business to expand, thus furnishing more employment and a greater volume of goods on an economical basis.

5. *Export Markets*—It must continue to cooperate with such agencies as ECA, and must make clear that ECA cannot function with true effectiveness unless it is supported by a foreign policy of our Government that will provide a degree of direction to the use of our loans and grants.

A report entitled "Machine Tools in Europe under ECA" was made by M. A. Hollengreen, chairman of the Committee on Governmental Relations and president of the Landis Tool Co., who recently made an extended visit to the European nations that are receiving assistance from the United States under the Marshall Plan. Mr. Hollengreen mentioned that not many Americans—including members of Congress—realize that the foreign governments which participate in the European Recovery Program are the real "directors" of ERP, rather than Paul G. Hoffman, administrator of the Economic Cooperation Administration.

Succinctly, Mr. Hollengreen observed, "The general spirit in France is not good. . . . The Belgian industry as a whole is worried about

the outlook because it has heavy inventories on hand which it cannot sell to the surrounding countries due to financial difficulties. . . . In Holland, conditions are not much better with respect to the importation of American machine tools than they are in France. . . . Of the eight countries visited, Switzerland was the only one where American dollars were at an actual discount. The problem of currency exchange is non-existent in that country.

"Italy has progressed further and accomplished more actual rehabilitation than any other country on the continent. . . . The Swedish government will not allow import licenses because of dollar shortage. . . . The British government has begun a series of trade negotiations with Soviet representatives having as the objective a long-term trade agreement.

"Practically all Europeans talked to could not understand why it was that the American government was not even indicating where and how ECA money should be spent. People requested, time and again, that America should change its policy of not saying anything to foreign governments about how our money should be spent."

Mr. Hollengreen suggested that our basic ERP policy should be re-examined to correct two things: First, our ECA policy of leaning over backward and of refusing to influence foreign governments in their programs for rehabilitation will have to be modified if the ECA Program is to avoid a continuance of relief rather than recovery; and second, some clarification of coordination of foreign policy is essential to adjust the paradox in which American manufacturers refrain from shipping goods to eastern Europe, while the countries to whom we are giving aid are regularly transacting business with those in the Russian orbit. Mr. Hollengreen made the striking observation that the standard of living in any country is in proportion to the number of machine tools in that country.

A paper presented by J. E. Lovely, vice-president of the Jones & Lamson Machine Co., traced the history of the American machine tool industry and its development of machine tools to their modern types, and outlined the present trends in the design of this manufacturing equipment.

Jerome A. Raterman, president of the Monarch Machine Tool Co., read a paper which emphasized the necessity of establishing a public relations program to keep before all classes of our population the advantages of the

(Continued on page 223)

Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Sliding-Block Mechanisms for Converting Rotary into Reciprocating Motion

By F. H. MAYOH

Rotary motions are frequently converted into reciprocating movements by means of sliding-block mechanisms. Such mechanisms generally include a box-shaped cast-iron lever arm in which a bronze block slides. Three different applications of this type of mechanism are shown in the accompanying illustrations.

A long eccentric block movement is shown in Fig. 1. In this construction, the large gear *A* is driven by a pinion *B*. Sliding block *L* is free to pivot about stud *C*, which projects from the face of the gear. When the gear is rotated in the direction indicated by the arrow, the sliding block will move lever *D* from the lower position shown to that indicated by the center line connecting points *M* and *Z*. *M* represents the upper position of connecting pin *N*, and *Z* indicates the common center of the stud and block when the lever is in its uppermost position.

As block *L* slides back and forth in member *D*, the lever *E* and shaft *G* to which it is pinned are reciprocated through arc *F* to operate a mechanism not shown. Connecting-rod *H* and adjustable links *J* and *K* join levers *E* and *D*. Point *P* represents the upper position of pin *Q*, while the center line joining points *P* and *M*, and broken lines *R*, indicate the uppermost position of the connecting-rod.

One feature of this design is that only a little more than one-quarter of a revolution of gear *A* is required to lift lever *E* to its vertical position. To return the lever to the position shown requires almost three-quarters of a revolution. In other words, the slow motion of lever *E* and shaft *G* is obtained while work is being performed on the machine, and the quick motion returns them to their starting positions.

A contrasting application of the same mechanism is the so-called "short eccentric block movement," Fig. 2. In this case, sliding block *F* is free to pivot about an eccentric stud *D*, which projects from flange *C* on driven shaft *B*. The shaft is mounted between frames *A* of the machine. Block *F* slides within the slotted box-like lever *G*, pivoting the lever about shaft *J*. Connecting-rod *H* joins one end of lever *G* with bell-crank lever *N*, which, in turn, reciprocates member *R* in ways provided on the table of the machine.

An interesting variation of the sliding-block movement is the cam-operated mechanism shown in Fig. 3. In this case, the lever *M* containing

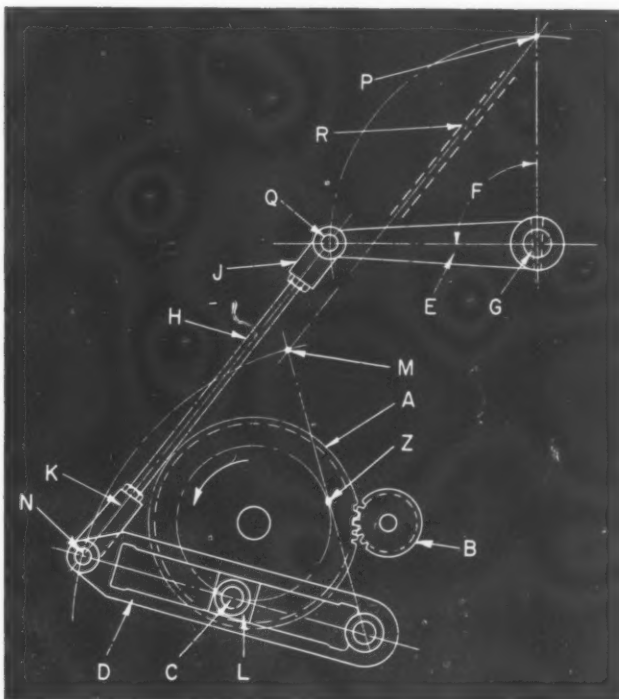


Fig. 1. Long Eccentric Block Movement in which Lever *E* is Quickly Raised to a Vertical Position and then Slowly Lowered to the Position Shown

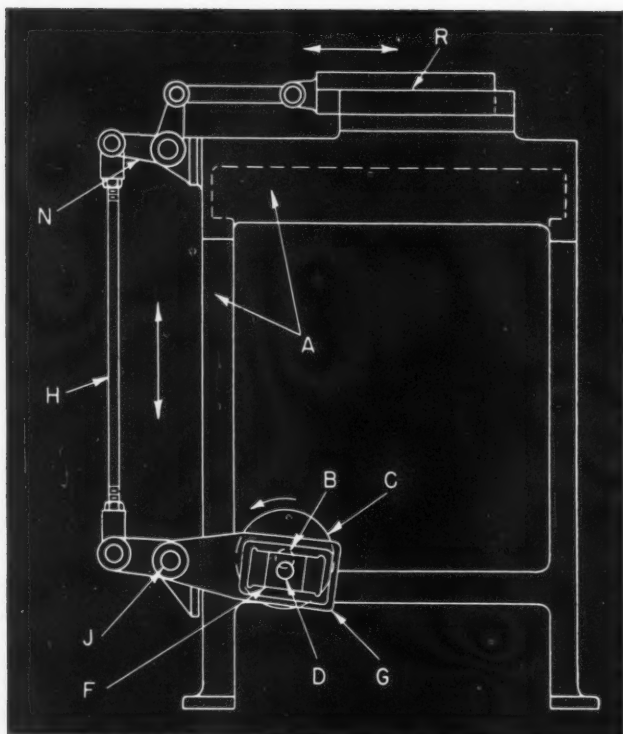


Fig. 2. Sliding Block F. Mounted on Eccentric Stud D, Employed with Connecting Linkage to Reciprocate Member R on the Table of the Machine

the sliding block *P* is on the driven rather than the driving end of the mechanism. Roll *B*, which rotates about a stud extending from lever *C*, fits in the grooved face of cam *A*. Lever *C* is hinged on pin *D*, so that it oscillates through arc *H* as the cam is rotated.

This motion is transmitted to the bellcrank lever *M* by connecting-rod *J*. The bellcrank lever is free to pivot about pin *T*, and its longer arm is slotted to fit sliding block *P*. Stud *R*, which passes through the sliding block and is secured to slide *L*, is confined to movement along center line *XX* by an elongated slot *N* in bracket *S*. As the slotted arm of the bellcrank lever is pivoted through arc *V*, slide *L* is reciprocated along center line *XX* in ways on bracket *S*.

In making such sliding-block mechanisms, it is sometimes advantageous to have the slot in which the block travels open at one end. This type of forked construction facilitates assembly, and is generally satisfactory when the travel of the block is small. In cases of longer travel or high-speed operation, it is usually necessary to increase the strength of the forked member or resort to a box type lever.

* * *

New Method for Cleaning Brass Prior to Electroplating

A new process for cleaning brass, copper, and copper alloys such as nickel, silver, and Monel metal prior to electroplating has been developed by the Chemical Research Laboratories of Oakite Products, Inc., 26 Thames St., New York 6, N. Y. Combined solutions of a specialized cleaner and an additive readily remove buffing compounds, cutting oils, forming oils, and dirt.

Solutions can be used with direct-reverse current cleaning, soak tank method followed by reverse current, anodic cleaning where only one cleaning tank is available, and cathodic cleaning. The solutions are said to offer the advantages of good cleaning action; resistance to tarnish on brass; free-rinsing action; freedom from surface scum; effective performance with hard water; neutralization of the effect of chromic acid in the cleaning tank; long life; high conductivity; and adaptability.

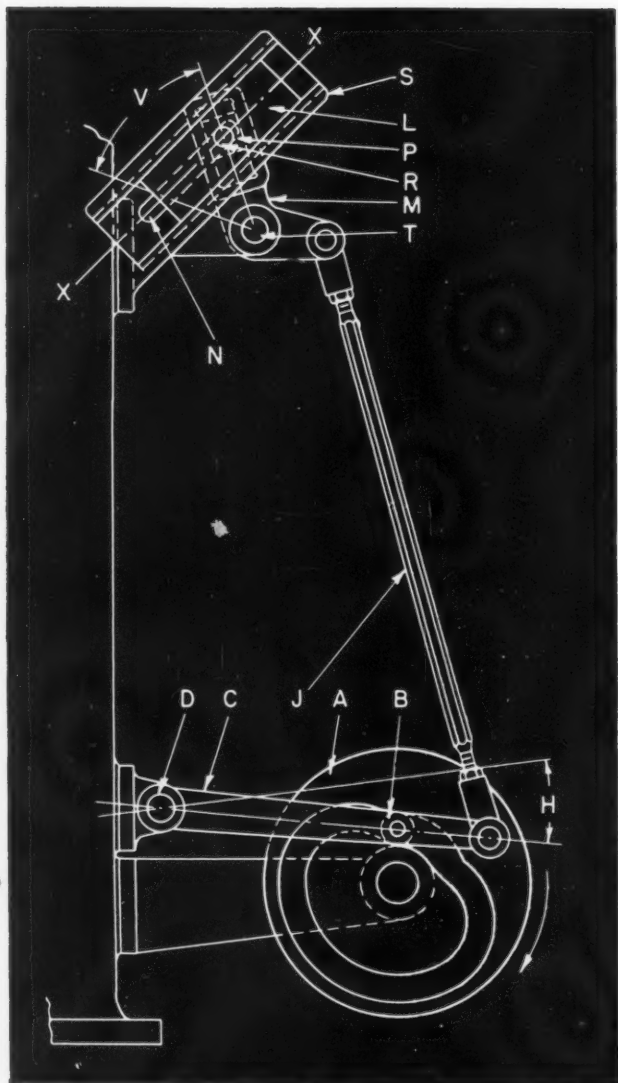


Fig. 3. Cam-operated Sliding Block Mechanism, which is Employed to Reciprocate the Slide L in Ways Provided on Bracket S

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Fixture for Drilling Spindle Rails of Various Lengths

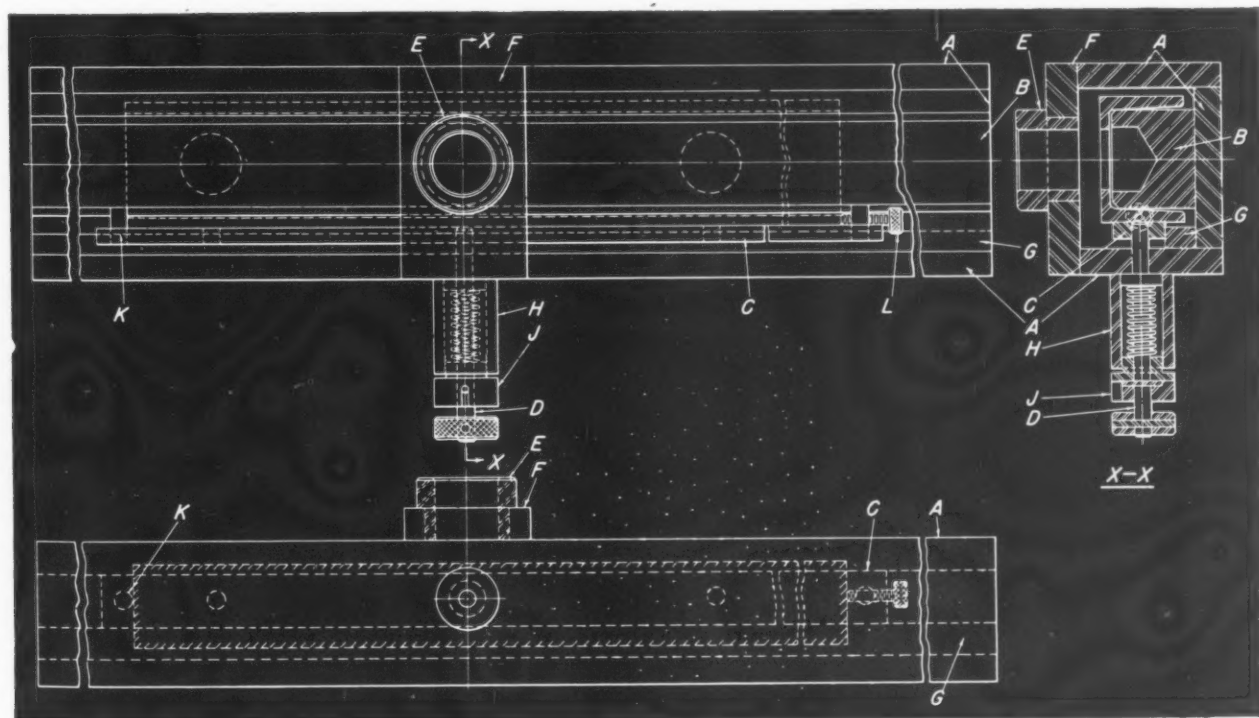
By HAROLD E. MURPHEY, Westerly, R. I.

For drilling textile machine spindle rails or other structural parts, a fixture similar to that shown in the accompanying illustration can be employed. This fixture is so constructed that work-pieces of various lengths, with different hole spacings, can be accurately drilled simply by changing an indexing bar in the base.

It consists essentially of three pieces of cold-rolled steel *A* which are bolted or welded together to form a U-shaped section; a solid steel block *B* on which the work rests; an indexing bar *C*; and a spring-mounted indexing pin *D*. When the fixture is in use, the part to be drilled is placed on block *B*, after which the indexing bar is positioned by stop *K* and tightened in

place by the knurled-head screw *L*. Then the work, with the indexing bar attached, is slid along block *B* until the indexing pin *D* snaps into the first hole in the bar. At this point the first hole is drilled in the work-piece. When this hole has been drilled, the indexing pin is pulled out of the indexing bar and the work moved until the pin snaps into the next hole. This procedure is repeated until the rail is finished. It will be seen that, regardless of the length of the spindle rail or the difference in hole spacings between parts, the basic fixture remains the same, and can be adapted to any spindle rail simply by changing the design of the indexing bar.

The other components of this fixture include the hardened and ground guide bushing *E* for the drill, which is made a drive fit in the plate *F* and the block *G* on which the indexing bar rests. The part *H* is the indexing pin sleeve, which is drilled and reamed for the indexing pin.



Textile Machine Spindle Rails or Other Structural Parts of Various Lengths, with Different Hole Spacings, can be Drilled in the Fixture Shown by Simply Changing the Indexing Bar *C*

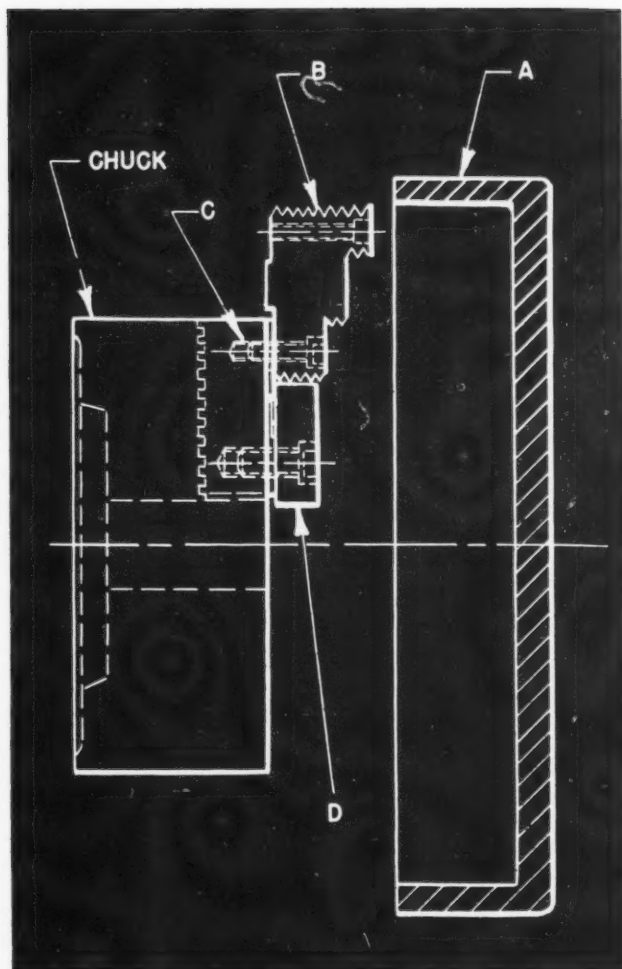
Increasing the Capacity of a Lathe Chuck

By JOHN MEYER, Glen Rock, N. J.

Small shops occasionally are faced with the problem of turning parts larger in diameter than can be accommodated in the lathe chucks available. By mounting the jaws as shown in the accompanying illustration, the capacity of such chucks can be increased considerably; for example, the aluminum casting *A*, which had a nominal inside diameter of 12 inches, was turned in a lathe chuck having a maximum capacity of 10 inches.

Both fastening screws through the jaws *B* were removed and the jaws raised until the tapped holes *C* corresponded with the top holes in the master jaws. Machined steel blocks *D*, fastened by the remaining screws, were used to prevent the top jaws from slipping radially inward.

This change, which was quickly made and at very little cost, increased the chuck capacity from 10 inches to 14 inches. A similar rearrangement can be made for any light-duty turning job.



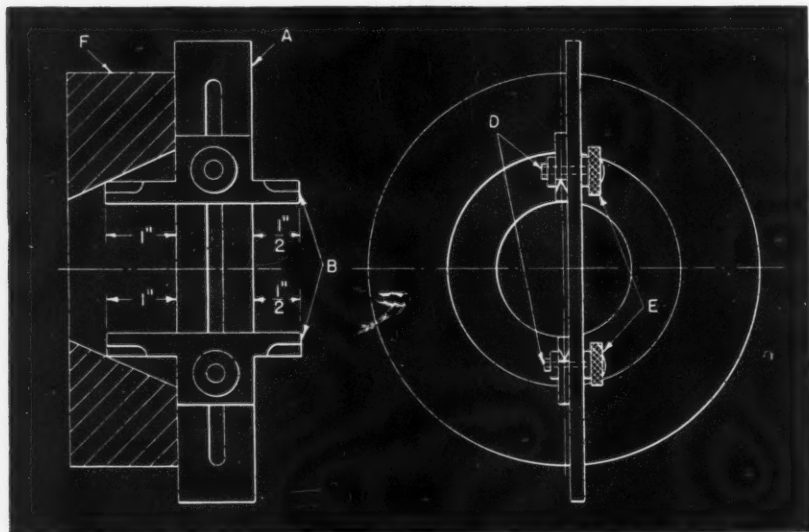
By Rearranging the Jaws *B* of a Lathe Chuck the Capacity was Increased from 10 to 14 Inches

Gage for Determining End Diameters of Tapered Holes

By H. MOORE, Kirkstall, Leeds, England

The measurement obtained by scaling the end diameter of a tapered hole is often inaccurate, and because the edge is not always sharp, caliper micrometers cannot be used. Although there

are other well known ways of determining this dimension, most of them are too involved for ordinary shop use. To overcome this difficulty, the taper gage shown in the accompanying illustration was designed.



Gage for Quickly Determining the End Diameter of a Tapered Hole

The main parts of the gage are the blade *A* and the sliding caliper arms *B*. A rib is machined on the body of the caliper arms to fit snugly in the groove or slot in blade *A*. Two screws *D* and two knurled nuts *E* serve to clamp the arms in position.

In use, the gage is positioned flat against the end of the work *F*, and the larger caliper arms are adjusted to fit the taper at a point 1 inch from the end of the hole. The gage is then removed, and the distance between the knife-edges on these arms is measured with a micrometer. Next, the 1/2-inch arms are set in the same manner, and that

dimension is also measured with a micrometer. The difference in the two measurements is then noted. As can be proved by trigonometry, this difference, when added to the diameter obtained with the 1/2-inch arms, is the correct diameter of the end of the hole. For example, if the distance between the 1-inch arms is 2 inches, and the diameter of the 1/2-inch arm is 2.500 inches, then the difference between the two—0.5 inch—added to the 2.500 inch diameter equals 3 inches, the diameter at the end of the hole.

Reciprocating Head for Auxiliary Operations on Milling Machines

By D. E. McDONALD and FRED SHRIER
The O.K. Tool Co., Inc., Shelton, Conn.

Many shops have designed special machine tool attachments to adapt their standard machines for auxiliary operations. Typical of such attachments is the hydraulically operated cross-head shown in Fig. 1, which can be mounted on the over-arm of column or knee type milling machines for internal keyway cutting, grooving, and other shaping operations.

The head is mounted in a stationary position on the milling machine and reciprocates up and down. The constructional details are shown in Fig. 2. A Meehanite casting A supports the cylinder assembly and acts as a guide for the

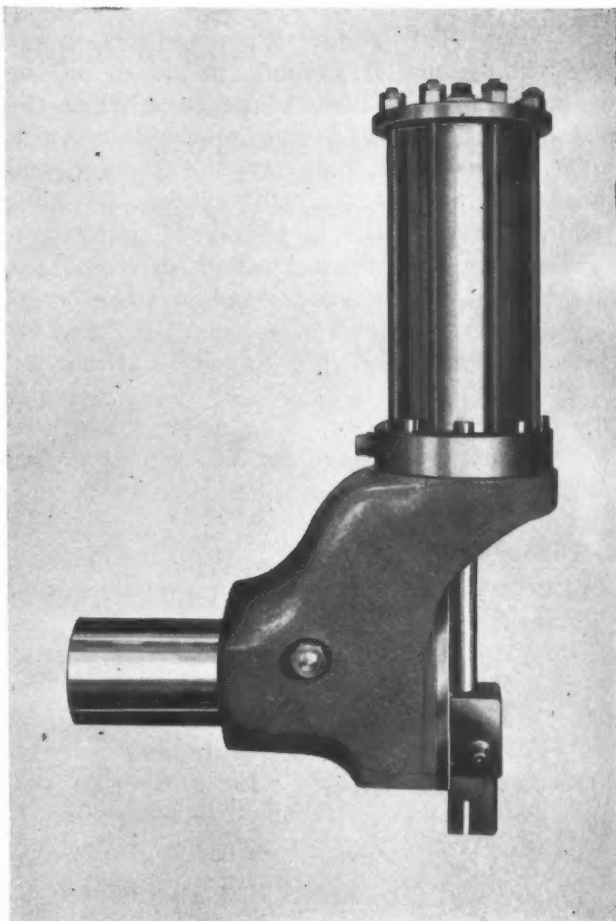


Fig. 1. Special Reciprocating Head that can be Mounted on a Milling Machine for Cutting Internal Keyways and Grooves or for Other Shaping Operations

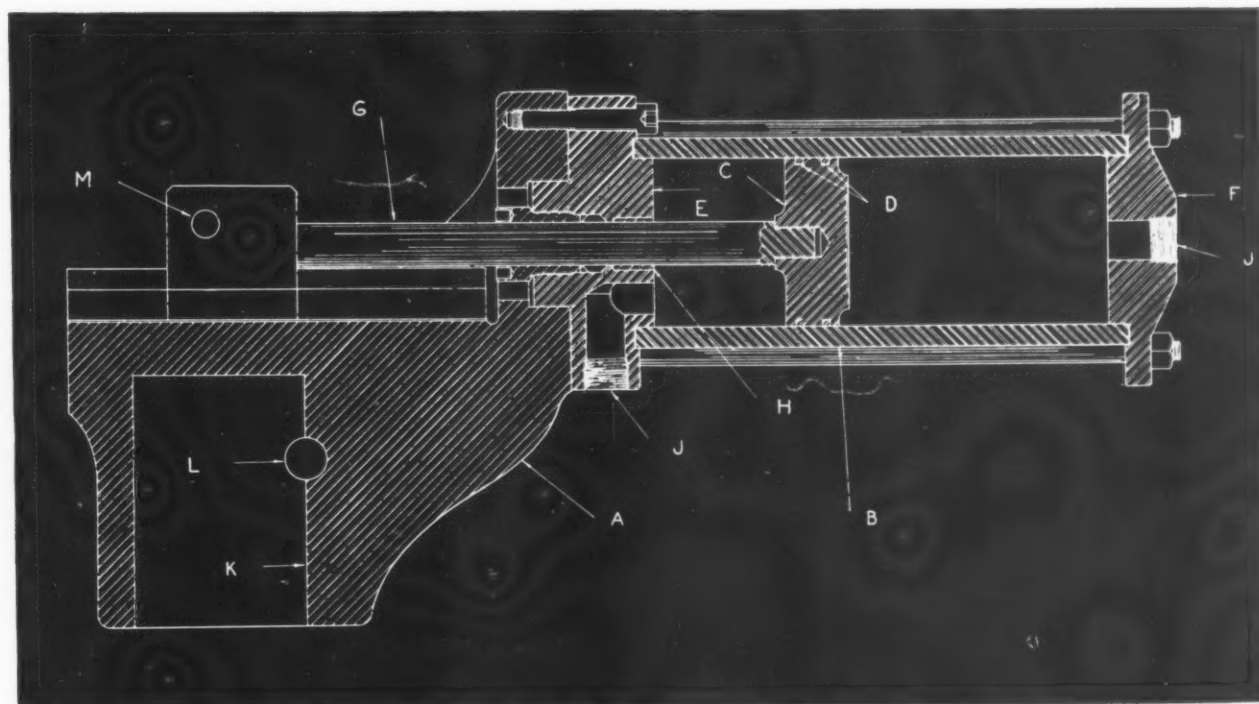
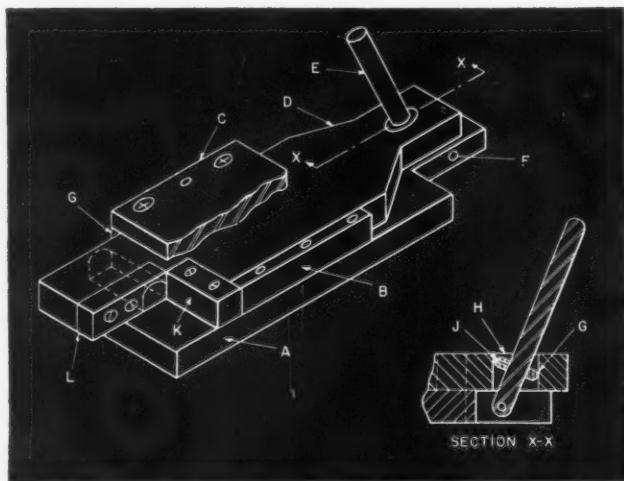


Fig. 2. The Head Consists of a Meehanite Casting A, a Cylinder B, a Piston C, and a Piston-rod G. The Piston is Reciprocated by Hydraulic Pressure

cross-head. The cylinder *B* is made of seamless steel tubing, and is ground and honed on the inside to provide a smooth surface on which the piston *C* and rings *D* can reciprocate. Two cylinder heads *E* and *F* support the cylinder, and the entire assembly is held together by eight 1/2-inch stud bolts. The piston-rod *G* is 1 inch in diameter, and is threaded on each end for attaching it to the piston-head and the cross-head. The piston-rod is held in alignment by the bronze bushing *H*, which also acts as a guide. Inlet to the top and bottom of the cylinder is provided through openings *J*, which are drilled and tapped for a standard 3/4-inch pipe connection. The cylinder assembly is held in position on the main-head casting by seven 1/2-inch socket-head bolts.

Casting *A* is bored at *K* so as to develop a close fit on the milling machine over-arm. A portion of the over-arm is machined flat to accommodate a taper-wedge lock-pin *L*. This arrangement provides a secure hold on the over-arm, and at the same time, provides positive locking action. Located in the cross-head is a tool-holder lock *M*. As the manner in which tools are fastened to the cross-head depends upon the type of work to be done, this particular feature should be designed to suit the requirements of the specific application.

In addition to the head, a small pump that will develop a maximum pressure of 1000 pounds per square inch is required. It is recommended that this pump be driven by a 5-H.P. motor. There are several small self-contained units on the market that combine a reservoir, pump, motor, regulating valve, and gage. However, if desired, the base of the milling machine can be used for the oil reservoir. A four-way control valve is used in the circuit to control the flow of oil between the pump and the cylinder.



Lever-operated Cutter with Variable Stroke

The cylinder is 4 inches in diameter and has a 7-inch stroke. By the use of the regulating valve on the pump, any desired pressure up to 1000 pounds per square inch can be obtained. It is evident that if the pump has a maximum pressure capacity of 1000 pounds per square inch, a maximum total head pressure, neglecting friction, of approximately 12,566 pounds can be produced.

Lever-Operated Adjustable-Stroke Heavy-Duty Cutter

By EDWARD DISKAVICH, Torrington, Conn.

Lever-operated slides often are not considered for certain applications because they usually have some backlash and are fixed as to length of stroke. These disadvantages have been eliminated in the design of the cable cutter shown in the accompanying illustration. The same principles can, of course, be adapted to many other shop mechanisms.

The assembly consists of a baseplate *A*, guides *B*, and a cover plate *C*, which is held in place by four screws and two pins. The mild-steel slide *D* moves between the guides and is actuated by lever *E*. This lever swivels on pin *F*; clearance for its movement is provided by a slot machined in base *A*. As can be seen by the section view of the lever assembly, the swivel-block *G* is essentially a section of a sphere, the thickness of which is approximately one-quarter of its diameter. Absence of backlash in the device depends on the closeness of the fit of this block in hole *H*, as shown in section *X-X*.

When the lever is fastened by the pin to the baseplate, and the swivel-block is secured to the lever by means of set-screw *J*, movement of the lever results in a movement of the slide in the same direction. The length of stroke can be varied by moving the swivel-block up or down on the lever. For best results, the diameter of hole *H* should be at least three times the slide stroke. For a long movement, it may be necessary to file clearance space for the lever around the outer edge of the hole. Otherwise, the lever will hit at this point and act as a stop for the device.

The only other parts of the cutter are the work-rest *K* and the cutting block *L*, which fits over a machined groove in the slide. Both of these blocks are made from heat-treated tool steel. After assembly, the cutter can be fastened to a work-bench by convenient clamps or machine screws.

Machine Tool Builders Study Security Problems

(Continued from Page 216)

free enterprise system. Other papers presented were: "Hydraulics for Machine Tools," by J. Robinson, assistant chief engineer of Vickers, Inc.; "Electrical Standards," by W. B. Wigton, electrical engineer of the Cincinnati Planer Co.; and "Apprentice Training Standards," by J. Edward Goss, Industrial Activities Administrator of the Brown & Sharpe Mfg. Co.

The guest of honor and speaker at the Wednesday luncheon was the Honorable Ralph E. Flanders, United States Senator from Vermont.

The following officers were elected for the coming year: President, Lloyd D. McDonald, vice-president of the Warner & Swasey Co.; first vice-president, David Ayr, president of the Hendey Machine Co.; second vice-president, Richard E. LeBlond, president of the R. K. LeBlond Machine Tool Co.; and treasurer, Louis Polk, president of the Sheffield Corporation.

New directors elected for a three-year term are: Ralph J. Kraut, president and general manager of the Giddings & Lewis Machine Tool Co., and Alfred V. Bodine, president and treasurer of the Bodine Corporation. Mrs. Frida F. Selbert was again named secretary. In addition to the officers and new directors, the board of directors includes Herbert L. Tigges, executive vice-president of Baker Brothers, Inc.; Milburn A. Hollengreen, president of the Landis Tool Co.; and Harold B. Smith, president of the Illinois Tool Works.

* * *

Westinghouse Materials-Handling Conference

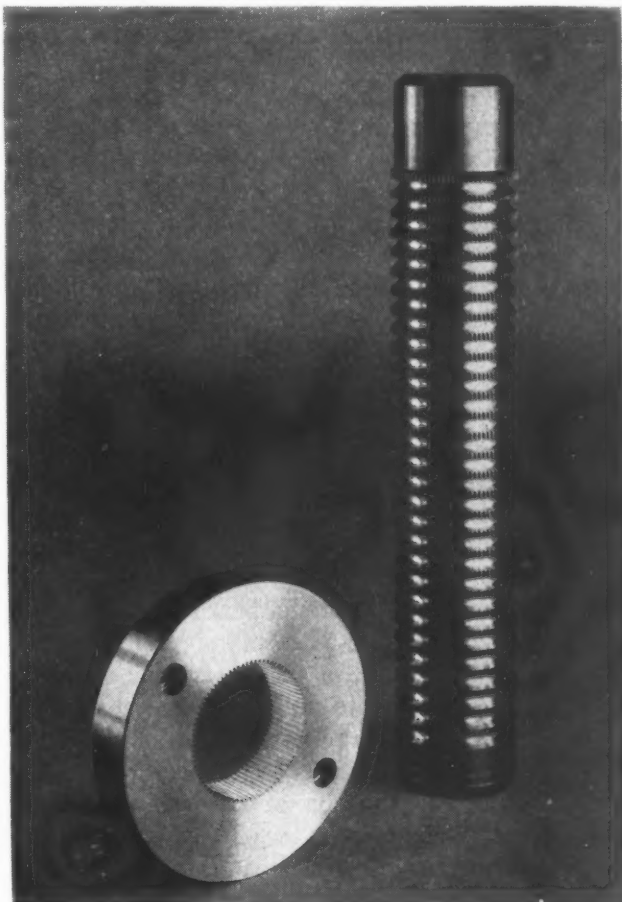
The second materials-handling conference sponsored by the Westinghouse Electric Corporation will be held in Buffalo, N. Y., on November 8 and 9. The first day's session will convene at the Hotel Statler, and the second day's session will be held in the auditorium at the Westinghouse Buffalo plant.

* * *

In order to rate experimental fuels under conditions that appear likely to exist within the cylinders of future internal combustion engines, the Ethyl Corporation, Detroit, Mich., has developed a special single-cylinder engine whose range of speed, manifold pressure, and compression ratio can be widely varied.

Push-Broach Used for Producing Fine Teeth

Fine-tooth splines of involute form are produced in the work-piece illustrated at the left by means of the push-broach shown at the right. The work is a sectional die used in making



Sectional Die for Camera-shutter Lever Winders in which Fine-tooth Splines are Broached

camera-shutter lever winders. The teeth are of 60 diametral pitch and have a pitch diameter of 1.3833 inches. A tolerance of 0.0002 inch is specified for the involute form, tooth spacing, and tangent radius of 0.007 inch at the top of the teeth. The width of the tooth roots is 0.00488 inch. The push-broach used for this operation was made by the National Broach & Machine Co., Detroit, Mich.

* * *

The use of aluminum for cathodic protection has a potential market in the petroleum industry for the protection of steel pipe lines and tanks. This use also extends to gas distribution lines, elevated water tanks, and numerous other structures, according to the Aluminum Co. of America.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

Sales Engineer and His Manager

THE sales manager's job is not an easy one. Management holds him responsible for a definite volume of profitable business. He must deal with factory officials, try to furnish them with orders for types and sizes of tools *they* want to build, and strive to secure shorter delivery dates and lower cost estimates. He must be on friendly terms with the design engineers, who can say "no" to an important request for a special tool. He must attempt to meet his competitors' terms or go them one better.

The best sales manager may not be a star sales engineer, nor does the best sales engineer always make the best sales manager. The important point is for the sales manager and the sales engineer to try to understand each other's problems and work together. Some of us know of sales managers who sit at their desk and write the sales engineer what to do, seldom going near him. Perhaps, too, we know sales managers who continually inject themselves into each sales negotiation, gather information, and then leave the sales engineer to guess how the information will finally be put to use. Some of us can point to a sales manager who is an "objector after-the-fact"—one who questions the course the sales engineer has taken.

The mind of the sales engineer is wrapped up in his customers' needs. To him these needs are real. Often he cannot understand why they seem to lose their reality when they reach the sales manager's desk. If only the sales engineer had a chance to fight for approval of a proposal the way he fights for an order!

What Constitutes a Good Sales Manager?

Analyses that have been made through questionnaires to sales engineers generally show that they characterize successful sales managers as follows:

A pleasant sales manager—one quick to discern, understand, and help.

A sales manager who makes prompt decisions and explains the reasoning behind them.

A sales manager who is loyal to the sales engineer and builds him up, yet has no favorites.

A sales manager who explains the need and intended use for requested information, and shows the results obtained through it.

A sales manager who leads more than he prods.

Briefly, sales engineers like a sympathetic, understanding, and helpful leader. They like a sales manager to be human, to deal with them as equals, and not as inferiors.

How Can the Sales Engineer Help the Sales Manager?

Deal with the sales manager in the same way that you would like him to deal with you. These suggestions may help: Get to know your sales manager; urge him to visit your territory; give him a true picture of it; don't steer him only to chronic kickers who can substantiate your complaints. Make your requests to the sales manager clean-cut and brief. Explain clearly the reasons for unusual requests.

Grasp the principle that every well run sales organization must have facts on markets, sales performance, and sales progress. These may be matters of daily reports, progress statements, estimates on business, or lost-business reports. When the paper work becomes burdensome, ask yourself how you would like to be the mouthpiece for a sales organization that had to report to management without facts to go on.

The resourceful sales engineer makes use of his sales manager—effective selling requires teamwork. Give your sales manager some problems to solve—not trick ones, but those that can be solved with his help. A happy working relationship between the sales manager and the sales engineer is one of the greatest business-getting assets a company can have.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Natco "Holesteel" Vertical Drilling, Boring, and Tapping Machines

Three vertical machines adaptable for drilling, boring, tapping, and similar operations on high-production lines, as well as for general miscellaneous work, are recent products of the National Automatic Tool Co., Inc., Richmond, Ind. These new machines are built in both single-spindle and fixed-center, multiple-spindle types. They are equipped with electrically controlled hydraulic feed systems which provide infinitely variable feeds within a range of from 1 to 10 inches per minute. The machines are controlled by electrical push-buttons.

The smallest size machine—the Model C2A—shown in Fig. 1, has a capacity for drilling a 2-inch hole in mild steel at a speed of 115 R.P.M. with a feed of 0.013 inch per revolution, and a 2-inch hole in cast iron at a speed of 134 R.P.M. with a feed of 0.023 inch per revolution. When equipped for multiple-spindle drilling, this machine has a capacity for drilling ten 3/8-inch holes in mild steel at a speed of 611 R.P.M. with a feed of 0.006 inch per minute, or ten 1/2-inch holes in cast iron at a speed of 535 R.P.M. with a feed of 0.008 inch per

revolution. The rapid traverse of this machine is at the rate of 215 inches per minute.

The single-spindle head has a direct motor drive, and is mounted in anti-friction bearings, as are the two larger models. Lever-operated sliding gears allow a selection of seven spindle speeds within any of five different ranges, selected by splined pick-off gears, covering a total range of 57 to 510 R.P.M.

The intermediate size machine (Model C3A), shown in Fig. 2, has a capacity for drilling 3-inch holes in mild steel at a speed of

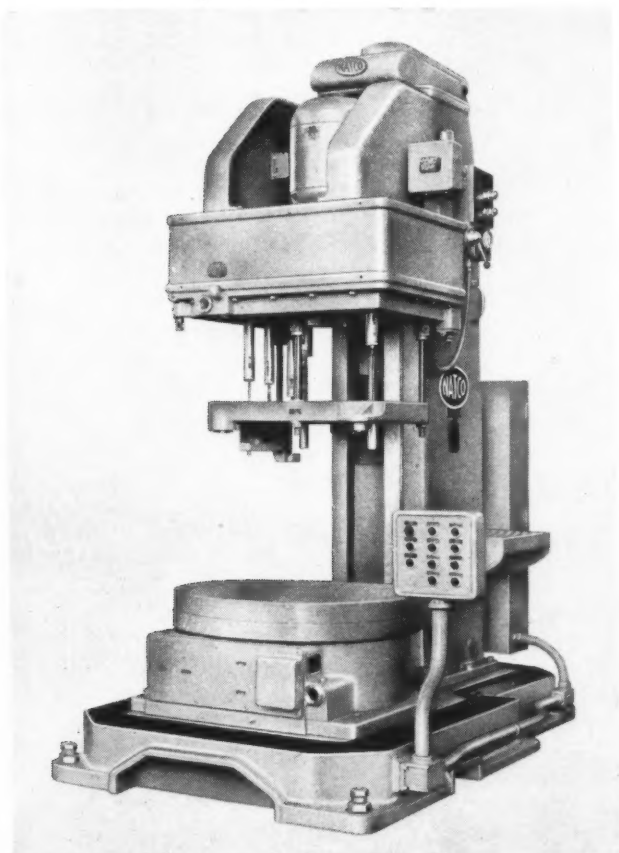


Fig. 1. Smallest of Three New Model Holesteel Vertical Drilling, Boring, and Tapping Machines Announced by National Automatic Tool Co.

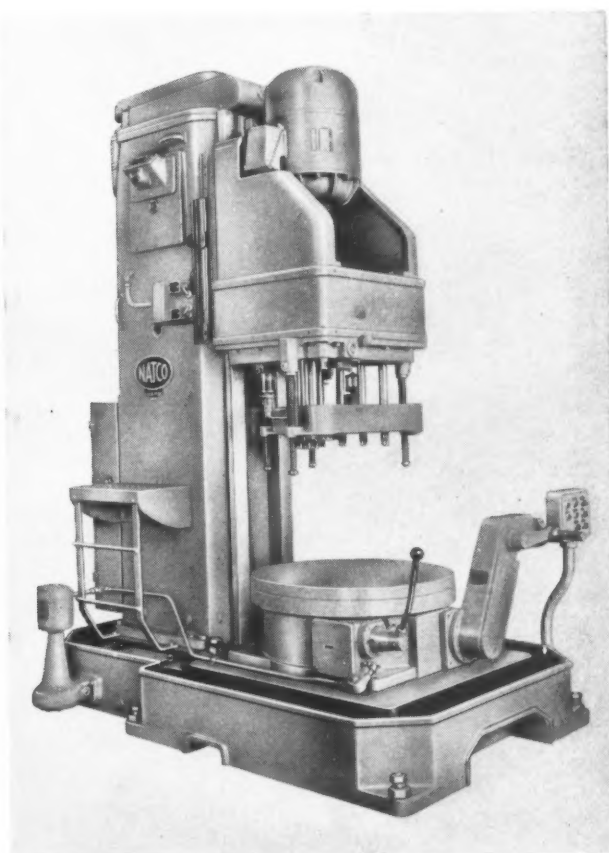


Fig. 2. Intermediate Size Holesteel Vertical Drilling, Boring, and Tapping Machine Brought Out by National Automatic Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 254.

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76 R.P.M. with a feed of 0.017 inch; when equipped for multiple drilling, it will drill ten 5/8-inch holes in mild steel at a speed of 367 R.P.M. with a feed of 0.007 inch. Pick-off gears give five different ranges of spindle speeds on this machine and the larger Model C4A machine, covering a total range of 25 to 308 R.P.M. The C4A machine has a capacity for drilling a 4-inch hole in mild steel at a speed of 57 R.P.M. with a feed of 0.020 inch per revolution; when equipped for multiple-spindle operation, it will drill ten 3/4-inch holes in mild steel at a speed of 306 R.P.M. with a feed of 0.010 inch per revolution.

The three single-spindle machines are 121, 132 5/8, and 137 1/2 inches high, and weigh 8000, 16,000, and 24,000 pounds respectively. When equipped for multiple drilling, their respective drilling area boxes range up to 19 by 28, 24 by 36, and 28 by 36 inches. The C2A machine requires a 2-H.P., 1800-R.P.M. motor for the pressure pump and a 5-H.P., 1800-R.P.M. motor for the driving head. The two larger machines require a 3-H.P., 1800-R.P.M. motor for the pressure pump. The C3A machine uses a

10-H.P., 1800-R.P.M. motor in the head of the single-spindle machine, while the corresponding requirement for the C4A machine is a 15-H.P., 1800-R.P.M. motor.

The travel of the head or head slide of the two smaller machines is 18 inches, and of the larger machine 21 inches. The distance from the center of the spindle to the face of the column ways on the three machines is 10, 14, and 17 inches. The maximum distance from spindle nose to working surface of base is about 55 inches for each machine; the minimum distance for the two smaller ma-

chines is about 37 inches, and for the largest machine about 33 inches.

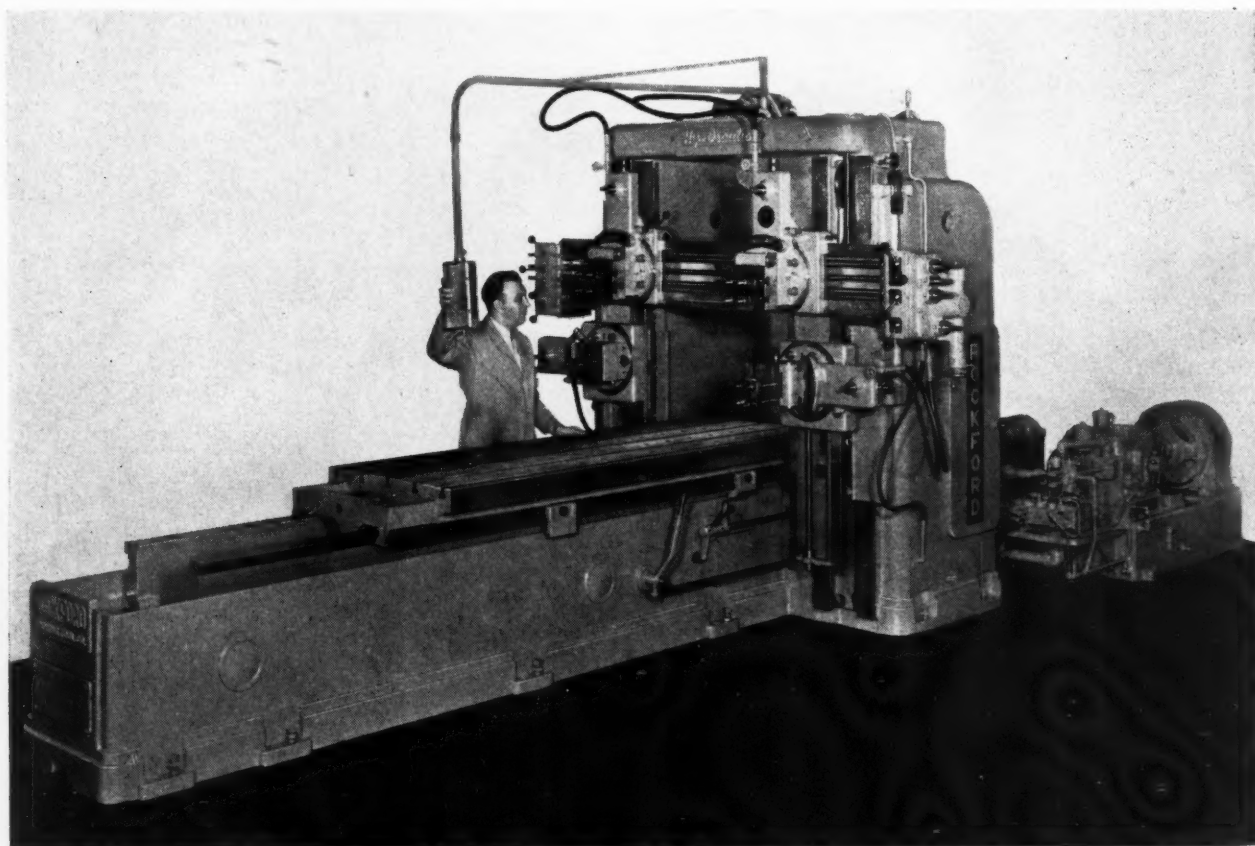
Each model can be supplied with either a small or a large base, the large base being suitable for rotating and sliding type fixture applications. The two smaller machines can be supplied with adjustable knee type tables. Combination drilling and tapping heads are provided with an independent reversing type motor for the tapping spindle drives. A step drilling attachment for automatic cycle drilling of deep holes can be furnished. 61

Rockford Double-Housing "Hy-Draulic" Shaper-Planer

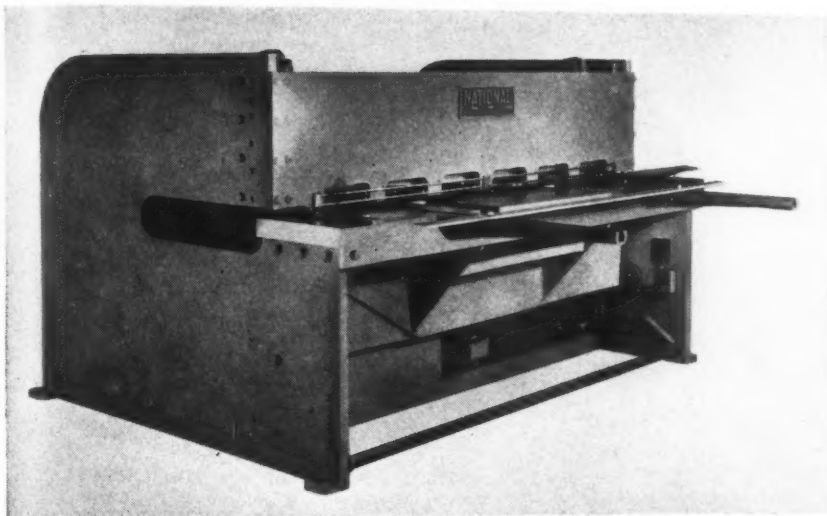
A shaper-planer with a double housing, designed to combine the speed of a shaper with the accuracy and convenience of a planer, has been added to the line of "Hy-Draulic" machine tools built by the Rockford Machine Tool Co., Rockford, Ill. The new machine employs hydraulic pressure for the feeds, as well as the table drive. It has been developed especially to meet the demand for a fast, small-sized planer that will handle heavy-duty "in between"

work that is too small for economical machining on a standard planer but too large for the average shaper.

The bed columns and rail of this shaper-planer are of heavy cross-section, designed to give rigidity under all working conditions. Two rugged columns provide the support required by the cross-rail tool-heads for handling heavy-duty work. Other design features include dual controls for rail head and table, two tool-



Double-housing "Hy-Draulic" Shaper-planer Built by the Rockford Machine Tool Co.



Gap Model Shears Brought out by National Machinery & Equipment Co.

heads with automatic tool-lifters for the cross-rail, and two side-heads, also with automatic tool-lifters, the second cross-rail head and side-head are furnished as extra equipment. The machine is built in three sizes—24- by 24-inch, 30- by 30-inch, and 36- by 36-inch—each with strokes of 6, 8, 10, and 12 feet.62

National Gap Model Shears

Shears with a 24-inch gap in the end frames have just been announced by the National Machinery & Equipment Co., Seminary Road and Columbia Pike,

Fairfax County, Va. Both squaring and gap model shears are being produced in 3/16- and 1/4-inch capacities and in 6-, 8-, 10-, and 12-foot lengths. They are available with front gage and back gage arranged for front operation; standard motor and controls; rod type finger guards; scrap chute; side slitting gage; and high-carbon chrome-alloy knives having four cutting edges. The hydraulic relief valve provides protection against overloads. 64

Cross Machine for Drilling and Reaming Valve Rocker-Shaft Brackets

The Cross Company, Detroit 7, Mich., has recently developed a special machine designed to facilitate both the finishing and handling of valve rocker-shaft brackets cast in clusters of four parts in a single piece. A total of 150 sets, or 600 individual valve rocker-shaft brackets, can be drilled and reamed an hour by a

Hard-Facing Electrodes

The Lincoln Electric Co., Cleveland 1, Ohio, has added to its hard-facing line two new tubular type shielded-arc electrodes designated Faceweld No. 1 and Faceweld No. 12, which replace electrodes previously manufactured under the name Faceweld.

Faceweld No. 1 is used for hard-facing parts of plain carbon, low-alloy, or manganese steel. It is designed to resist severe abrasion, as well as moderate impact.

Faceweld No. 12 is an electrode of the same type as Faceweld No. 1, but is designed for use where the hard-faced surface must withstand extremely severe abrasion, as well as some impact. The deposit is harder than that of Faceweld No. 1, but not as tough. The deposits of both No. 1 and No. 12 electrodes maintain high abrasion and hardness values at red heat, and their corrosion resistance is comparable generally to that of stainless steel. The electrodes operate on either alternating or direct current. Available in 14-inch lengths and in 5/16- and 3/16-inch diameters. 63



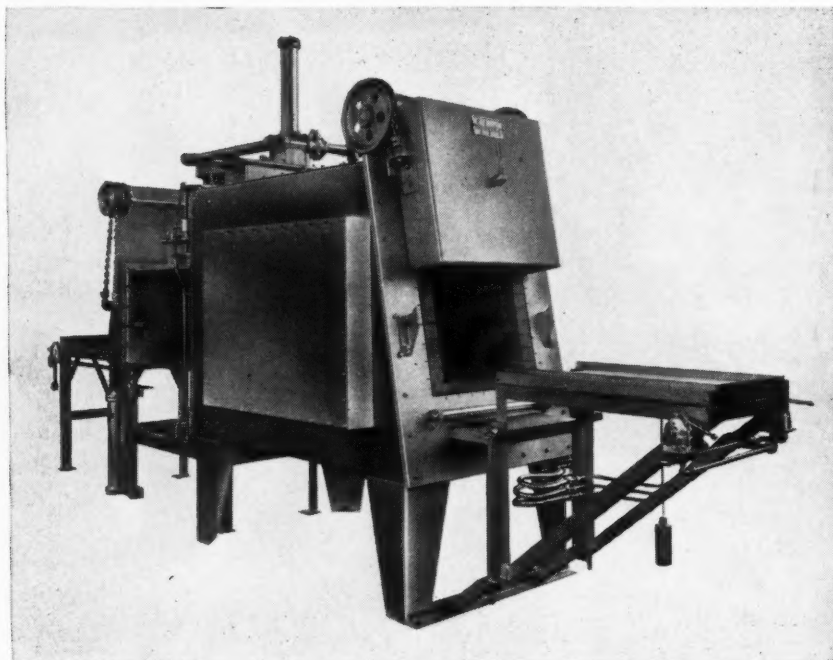
Special Machine for Drilling and Reaming Valve Rocker-shaft Brackets Developed by The Cross Company

single operator, ten holes being completed in each casting.

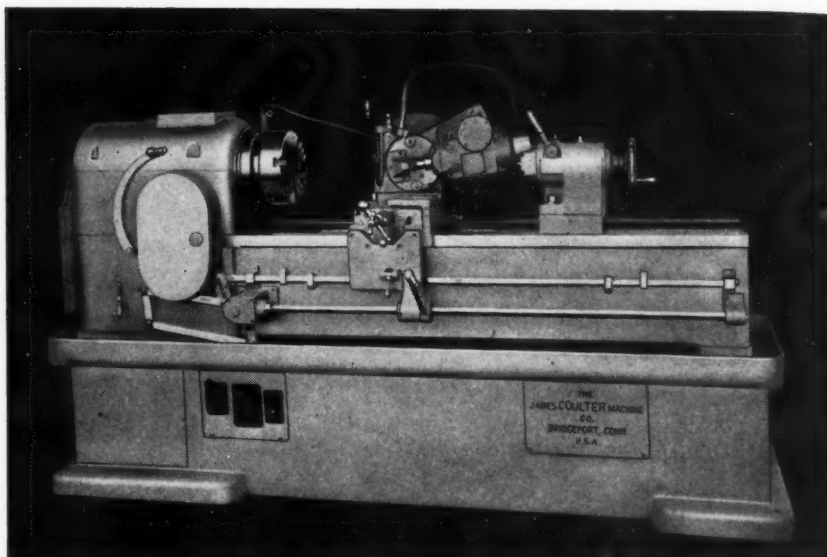
The machine has a seven-station, power-operated indexing table, and is equipped with a hydraulically controlled feed. Loading and unloading operations are accomplished at an independent station while the machine is cutting two clusters at each of the six working stations. Thus, twelve sets, or forty-eight parts, are machined at one time, progressively.65

Lindberg Controlled-Atmosphere Furnaces

An all-purpose controlled-atmosphere furnace, a continuous-flow vibrating-hearth furnace with salt quenching tank for "Martempering" or "Austempering," and a recently announced "Hi-life" pot furnace were exhibited for the first time by the Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill., at the recent Metal Show in Philadelphia, Pa. The controlled-atmosphere furnace is adapted for hardening both high-speed and air-hardening steels. It is also built for brazing and sintering operations. Heating is by Globar elements, and the unit is built to operate at temperatures up to 2500 degrees F. A built-in propeller type fan in the top of the cooling chamber circulates the



Lindberg All-purpose Controlled-atmosphere Furnace



Thread Milling Machine for Long Work Built by James Coulter Machine Co.

protective atmosphere, providing faster and more uniform cooling.

The continuous-flow, vibrating-hearth, controlled-atmosphere furnace is especially designed for hardening small parts. The vibrating hearth moves the work through the work chamber to a chute through which the parts fall into the quench. The movement of the hearth is not perceptible, and there is no jarring of the furnace equipment. This furnace is built for temperatures up to 1800 degrees F., and is electrically heated by heavy nickel-chrome elements.66

Coulter Thread Milling Machine

A new Model TM "Thread Master" of the single cutter type for milling exceptionally long threads has been added to the line of the James Coulter Machine Co., Bridgeport, Conn. It is adapted for performing thread milling operations in job shops where many different threads must be milled, as well as for use in plants producing screws on a high-production basis.

The work-spindle and cutter-spindle are driven by individual two-speed motors, which give a wide range of speeds for hard and soft materials of large and small diameters. The work-spindle speed is changed by pick-off gears, the gears regularly furnished giving twenty-nine spindle speeds in each motor speed range, making a total of fifty-eight spindle speeds.

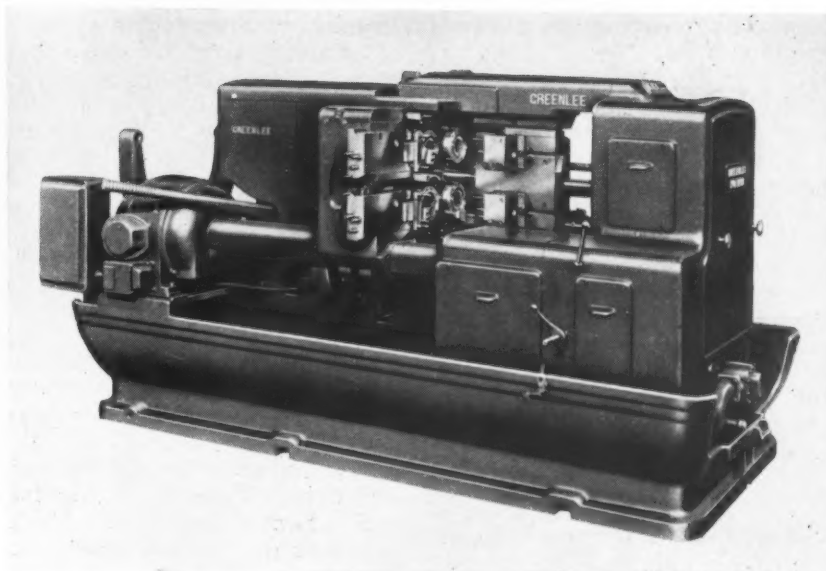
The cutter-spindle speeds range up to 300 R.P.M. for high-speed steel cutters, and up to 900 R.P.M. for carbide-tipped cutters. Standard gears provide for cutting U. S. form, Acme, and worm threads from 1 to 20 per inch and diametral-pitch worms of 7 to 20 pitch. Multiple threads with leads from 1/2 inch to 3 inches can also be cut.

The machine will swing work up to 10 inches in diameter over the cross-slide and 16 inches over the ways of the bed. The 4-inch hole through the spindle permits the use of air-operated collet chucks. Long work up to 4 inches

in diameter can be inserted through the hole in the spindle. Provision is made for rapid traverse in the direction opposite the threading travel without any change in the threading speed of the spindle. Balance wheels on both ends of the drive serve to smooth out the transmission of power to the cutter. Each motor has its own control for changing the direction of rotation and speed, a feature that simplifies the cutting of right- and left-hand threads with either climb or conventional cut. The machine is made in three bed lengths to accommodate work 24, 42, and 60 inches long between centers.....67

Greenlee Automatic Screw Machine

Greenlee Bros. & Co., 1870 Mason Ave., Rockford, Ill., have recently made several changes in their 2 5/8-inch four-spindle automatic screw machine. One of the changes is the addition of an over-arm that gives the machine a more streamline appearance, and at the same time, increases the rigidity of the spindle-carrier housing, thus adapting the machine for heavier tooling. The main tool-slide has also been



Greenlee Improved Four-spindle Automatic Screw Machine

strengthened by the addition of gibbed ways fastened to the over-arm. The new main clutch unit is designed to insure a positive feed for handling heavier cutting loads.

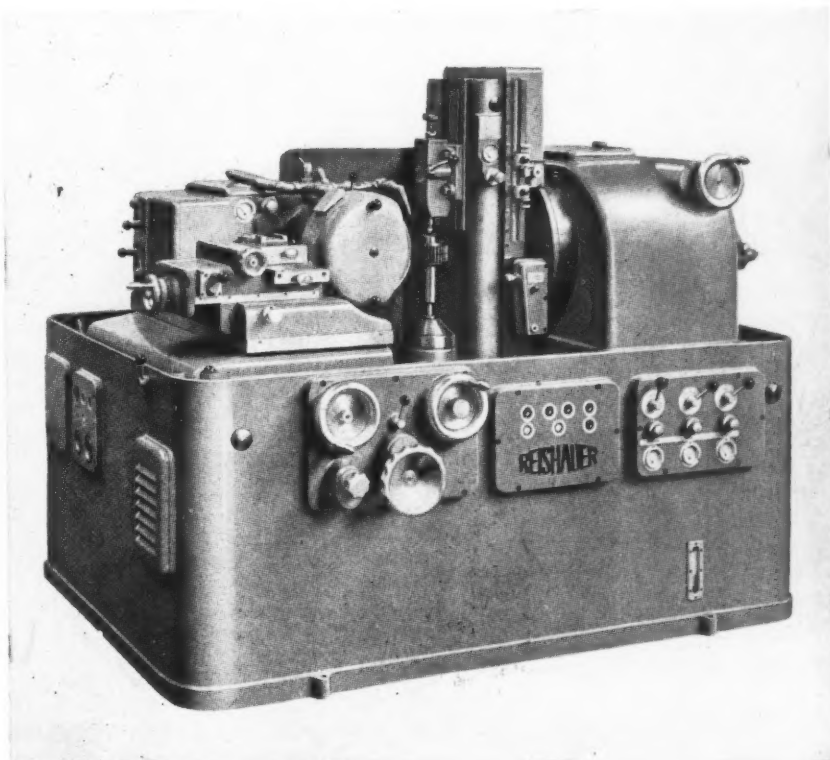
The four parallel cross-slides are actuated through a system of cams that can be easily and quickly interchanged, a feature that considerably reduces equipment costs. Other distinctive features include rapid adjustment of

the main tool-slide stroke through the use of a graduated worm-wheel; accessible tooling area for quick set-ups and easy operation; and standardized interchangeable tooling. Work up to 8 3/16 inches long can be handled.....68

Reishauer Gear Grinding Machine

The Cosa Corporation, 405 Lexington Ave., New York 17, N. Y., exclusive agent in the United States for the Reishauer Tool Works, Ltd., Zurich, Switzerland, exhibited a new Reishauer gear grinding machine at the recent A.S.T.E. exposition in Cleveland. This gear grinding machine operates on the generating principle, similar to that employed in milling gears. A single-thread grinding worm with a rack profile is employed. The grinding worm generates the theoretical shape of the tooth by an infinite number of enveloping grinding cuts.

This gear grinding machine is suitable for grinding spur and helical gears up to a diameter of 9 1/2 inches and 6 diametral pitch. Gears with diametral pitches below 32 can also be ground economically from the solid blank. The grinding process is continuous, and is not interrupted by dividing or indexing operations. The machine operates automatically, and is adapted for mass production work on gears that must be held to very close tolerances. The time required for re-profiling the grinding worm is



Reishauer Gear Grinder which Operates on the Generating Principle

To obtain additional information on equipment described on this page, see lower part of page 254.

about 12 per cent of the effective grinding time. The profiling of the grinding worm is accomplished by equipment developed especially for the purpose.

A 3- to 5-H.P. synchronous motor drives the grinding worm, and a synchronous motor up to 8 H.P. is employed for driving the work. The additional rotating movement of the work required when grinding helical gears is obtained by means of a differential gear fitted between the work motor and the change-gears, a sine bar being employed to obtain fine adjustment.69

Cincinnati All-Steel Shear

An all-steel shear with a capacity for shearing mild steel sheets 12 feet long by 1/4 inch thick has been brought out by the Cincinnati Shaper Co., Cincinnati 25, Ohio. An outstanding feature of the new shear is the very low rake or shear angle of the upper knife, which insures shearing strip stock with a minimum of twist, bow, or camber. It is said that the low rake angle makes it possible to shear 10-gage strips, 1/4 inch wide by 10 feet long, without twist.

This type of shear has been developed to obtain considerable

savings by converting sheet stock to accurately sized flat strips that are to undergo forming, punching, drawing, or other operations. Another interesting feature of the

shear is the new light-beam shearing gage, which facilitates shearing to a scribed line when producing gussets and other irregular-shaped pieces.70

Rowbottom Cam Milling Machine

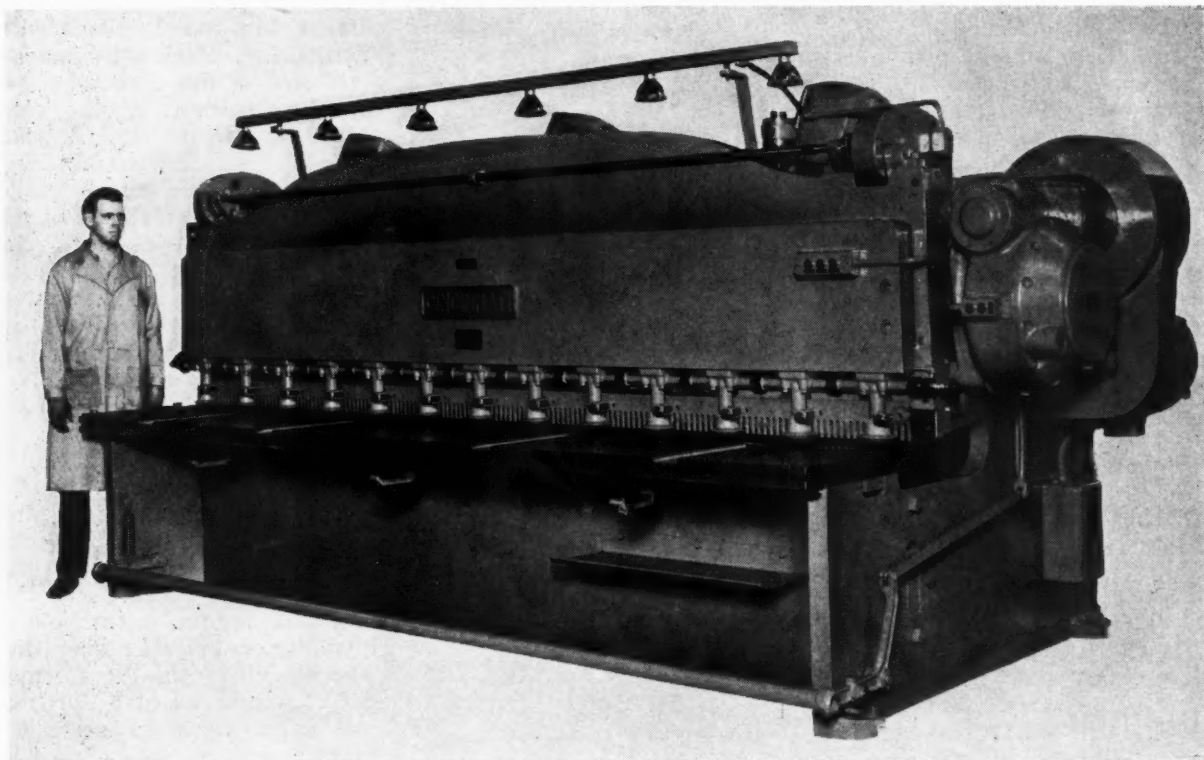
The Rowbottom Machine Co., Inc., Waterbury, Conn., is placing on the market a new cam milling machine, designated No. 348, which was exhibited at the recent Olympic Machine Tool Show in London, England. This machine is designed for the high-production machining of box and face cams. It has a capacity for cams having maximum blank diameters of 8 inches, which can be machined within a center-of-cam to center-of-cutter distance of 3 3/4 inches, using a cutter 3/4 inch in diameter. The machine can be furnished completely wired with all motors and controls for operation on a wide range of current voltages.

The six cutter speeds obtained with the standard 3/4-H.P., 1200-R.P.M. motor range from 460 to 1800 R.P.M. However, the machine can be furnished to provide cutter speeds ranging from 700 to 2700 R.P.M., if desired. The cutter-head is essentially a four-spindle turret with spindles

for roughing, intermediate, and finishing cutters. The clutches on the spindles are so arranged that only the spindle indexed to the top position turns.

The cutter is fed into the work manually. The feed dial has 0.001-inch graduations, and one revolution of the handle gives a feeding movement of 0.125 inch. A stop-screw with check-nut is provided for each turret position. The work-rotating feeds obtained with the standard 1/2-H.P., 1200-R.P.M. feed motor are at the rates of 3 minutes and 5 3/4 minutes per revolution. With special sheaves, a range of 1 to 8 1/2 minutes per revolution can be obtained. The work can also be revolved manually, one turn of the rotating dial rotating the work through an angle of 5 degrees.

The master cams are usually made of cast iron about 1/2 inch thick. The throw on the master cam is the same as on the cam to be cut. The master cam is clamped to the work-spindle, and



Cincinnati All-steel Shear Developed for Accurate Shearing of Long Narrow Strips from Sheet Stock

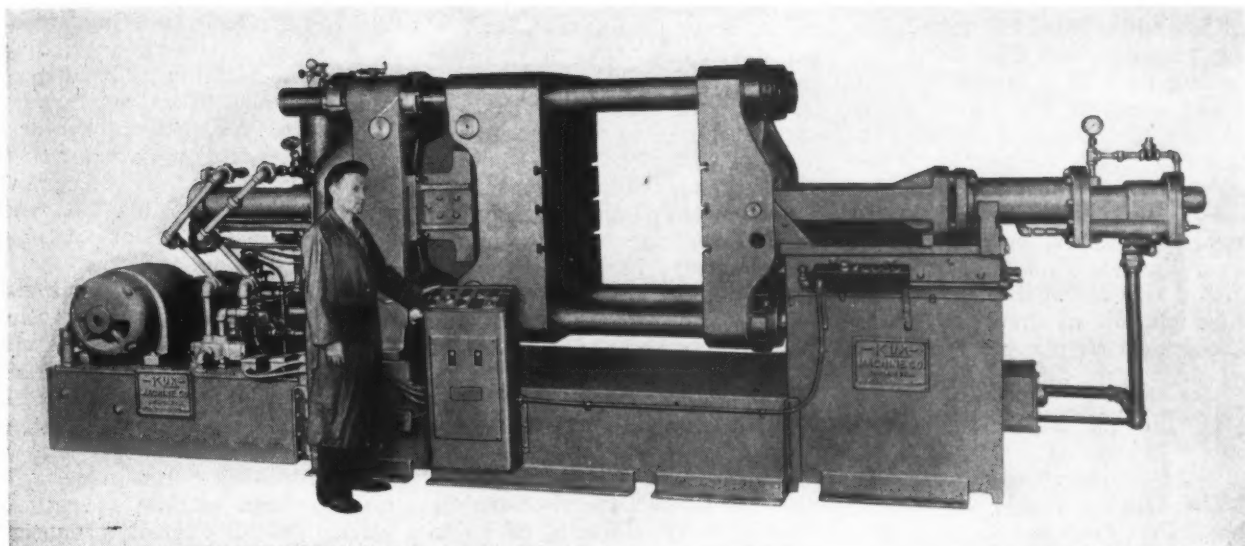


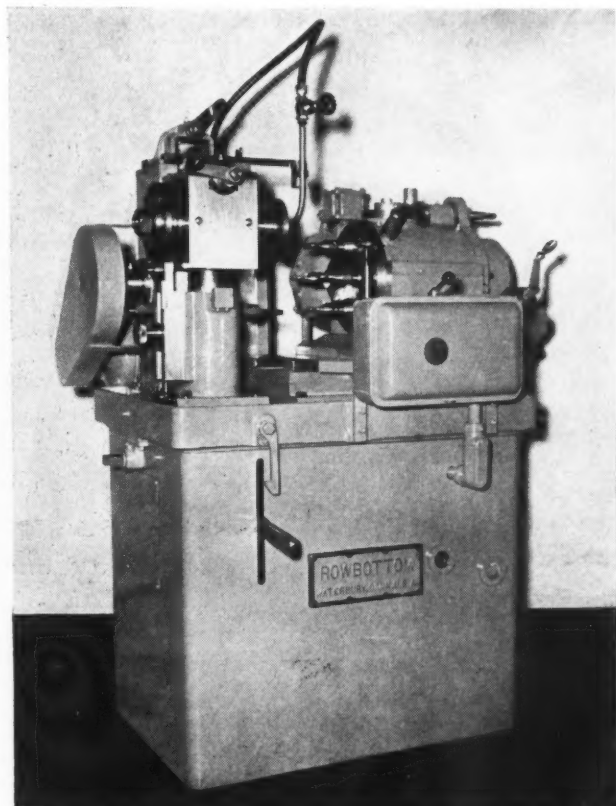
Fig. 1. Kux Die-casting Machine Equipped with Cold-chamber Hand-ladling Injection Unit

is easily adjusted to the work. The height setting is made with a screw-adjusted bracket by means of a dial having 0.001-inch graduations. The coolant and oil circulating pumps are driven by 1/10-H.P., 3600-R.P.M. motors. The machine is 42 inches wide by 39 inches deep, by 56 inches high, and weighs 1600 pounds. 71

Kux Die-Casting Machine

A huge die-casting machine, said to be the largest in the world, has just been introduced by the Kux Machine Co., 3940 W. Harrison St., Chicago, Ill. This machine has a locking pressure of 800 tons, and is available in three models. It will form castings of zinc and aluminum

weighing up to 30 pounds and 10 pounds, respectively. Extremely high injection pressures ranging up to 40,000 pounds per square inch are employed. There is a die space of 40 by 25 inches between the tie-bars, and 17 1/2 inches of die separation. The two-way double locking toggle will



Motor-driven Cam Milling Machine Recently Placed on the Market by the Rowbottom Machine Co., Inc.

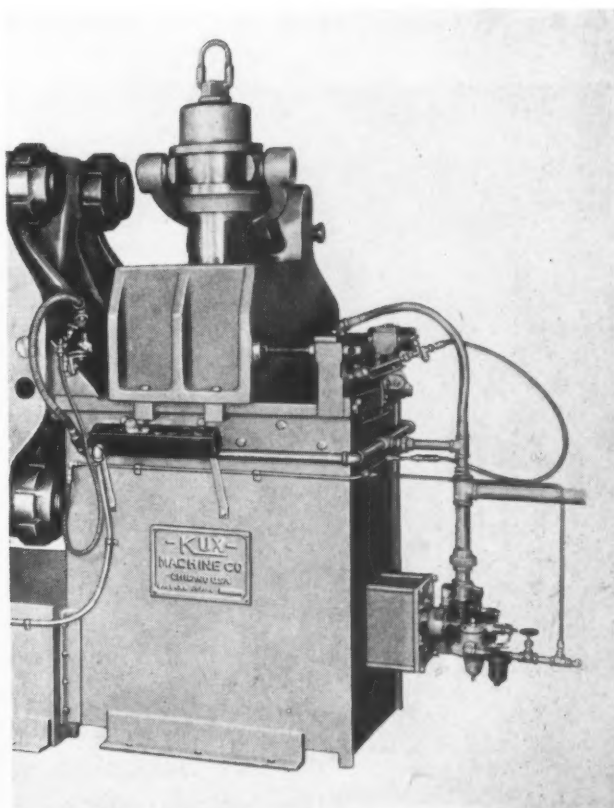


Fig. 2. View Showing Self-contained Melting Pot and Furnace on Gooseneck Plunger Type Die-casting Machine

To obtain additional information on equipment described on this page, see lower part of page 254.

withstand its rated 800 tons holding pressure, and thus keep the casting flash at a minimum.

The complete die-casting cycle on this machine is hydraulically operated and electrically controlled by push-buttons.

For the production of aluminum, magnesium, or brass castings, the machine is furnished with a cold-chamber hand-ladling injection unit, as shown in Fig. 1. The gooseneck plunger type ma-

chine for producing zinc, lead, or tin die-castings has a self-contained melting pot and furnace incorporated within the frame of the machine, as shown in the close-up view, Fig. 2. When constructed as a convertible machine, a gooseneck plunger mechanism is used for zinc castings, and a cold-chamber hand-ladling unit for aluminum. Conversion from one style of die-casting to the other requires minimum time...72

ing broken tools, welding extensions on drills, reamers, grinding wheels, etc., joining coils or rings, and numerous other repair jobs, as well as for production work. The weld cycle is motor-controlled and fully automatic. Mechanical coordination of welding heat and pressure insures welds of uniform density and purity.

This welder is also equipped with a grinding unit for preparing the material to be welded and for grinding off flash after welding. A saw thickness gage is included on the grinding unit for dressing the welded blade to the proper thickness. The welder will also perform etching operations when an etching pencil is connected to the welding jaw. Thus the machine can be used for permanent marking or numbering of tools, dies, and machine parts...73

DoAll Band Filing Machine and All-Purpose Flash Welder

The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., has announced a new band filing machine (Fig. 1) and a flash welder (Fig. 2). The band filing machine has a table height of 39 inches, and is designed for operation in either a sitting or standing position. The work-table is 18 inches square, and is lighted by an adjustable lamp. Work up to 7 inches thick can be filed.

A 1/2-H.P. motor drives an enclosed worm reduction gear governed by a Speedmaster variable pulley. Maximum cutting speed for any material is instantly available by turning a handwheel on the Speedmaster which con-

trols the surface travel of the file band in a speed range of 50 to 250 feet per minute, the operating speed being shown by an indicator.

A built-in air pump clears the work of chips, making it easy to follow guide lines. A tilting mechanism permits accurate level, miter, or angle cutting. The file band is 120 inches long. The bands are made in 1/4, 3/8, and 1/2 inch widths in six types of cut, as well as in flat, oval, and round shapes.

The new flash welder will join wire, bars, flat stock and drill rod up to 5/16 inch in diameter. It is especially adapted for salvag-

Rettig Hydraulic Turret Press

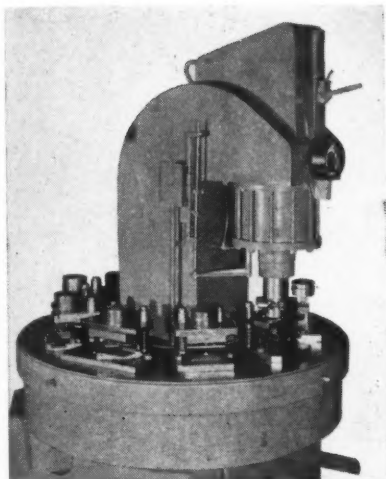
A hydraulic turret press has been brought out by the Rettig Engineering Co. which is to be distributed through the Universal Air-Line-Joint Mfg. Co., Lafayette, Ind. This press is designed to operate at high speed and to reduce setting up time to



Fig. 1. DoAll Floor Model Band Filing Machine



Fig. 2. Flash Welder Built by the DoAll Co.



Hydraulic Turret Type Press
Brought out by the Rettig
Engineering Co.

a minimum. It is especially adapted for short-run work.

The new press has a large turret table which will accommodate several set-ups. After the fixtures are mounted on the turret, the operator can change quickly from one fixture to another, thus making it possible to perform blanking, forming, drawing, swaging, assembling, and similar operations without loss of time.

The press equipment includes a load gage, electric limit control, electric overload control, and magnetic power valve submerged in oil. A magnetic push-button starter is provided, and the power drive is through V-belts and pulleys.

The turret has an outside diameter of 48 inches and an inside diameter of 20 inches. The ram stroke is 4 1/8 inches maximum and 1/4 inch minimum. The maximum distance between the turret table and the ram is 10 1/4 inches and the minimum 6 1/8 inches. The floor space required is 48 by 56 inches. The height of the turret table from the floor is 37 1/4 inches, and the over-all height of the machine is 83 1/2 inches.74

Zagar Gearless Drill Head

Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio, has recently built a special gearless multiple-spindle drill head for a Sigourney sensitive drill press of small size, designed for light-weight work. The housing and the drive mechanism of the Zagar head are an integral part of the main spindle assembly, the

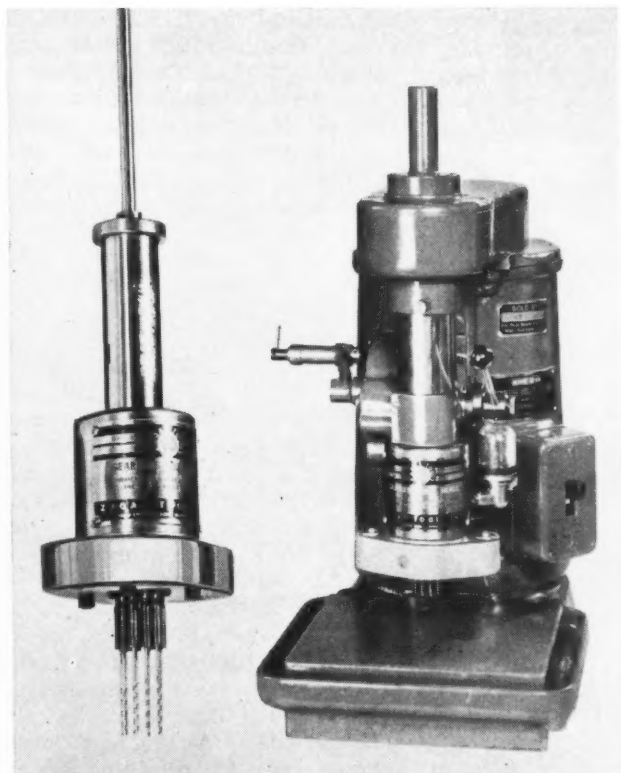
original drill press spindle being removed and replaced by the multiple-spindle drill-head unit.

The view to the left in the illustration shows the special drill-head unit, while the view to the right shows the Sigourney drill press with the Zagar gearless drill-head unit installed. The gearless head has eight spindles grouped on a 1-inch circle.75

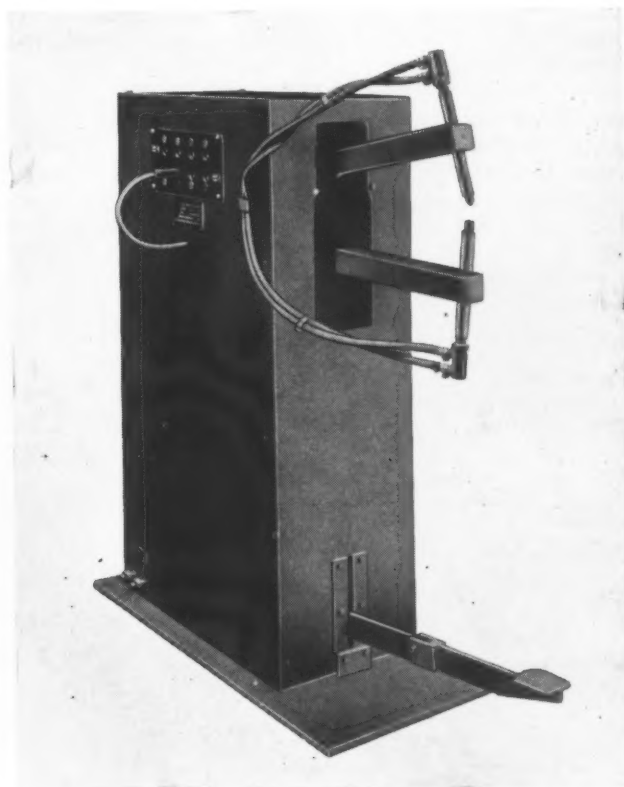
New Line of Spot-Welders

Electric-Arc, Inc., 152-162 Jelliff Ave., Newark 8, N. J., has announced a new line of electro-weld spot-welders designed for fast, economical production. The heavy-duty unit illustrated has eight-step current control, which permits a 75 per cent secondary voltage adjustment.

The electrodes are of standard size, water-cooled, and can be easily and quickly renewed. Equipment includes a spring-loaded foot switch and arc-welded steel casing with removable top and rear door. The welder operates on 220-volt, 60-cycle, single-phase alternating current. If desired, these units can be furnished with magnetic contactors and weld timers. 76



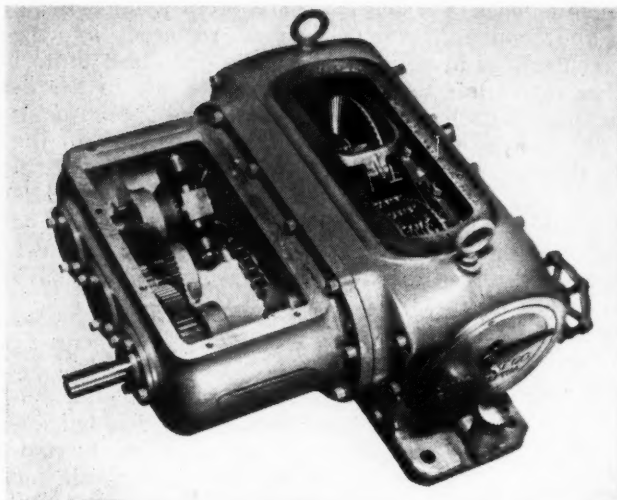
(Left) Zagar Special Gearless Drill-head Unit
(Right) Sigourney Drill Press with Gearless Head



One of a New Line of Heavy-duty Spot-welders
Placed on the Market by Electric-Arc, Inc.

To obtain additional information on equipment described on this page, see lower part of page 254.

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Variable-speed Transmission Brought out by the Speed Control Corporation

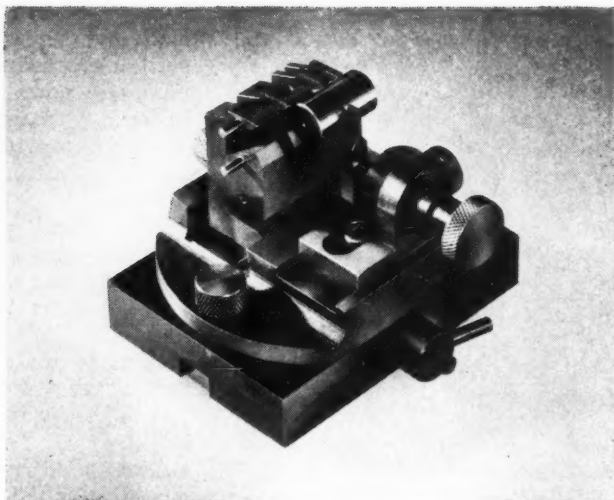


Fig. 1. "See-All" Thread Staging Fixture Brought out by the Engineers Specialties Division

"Specon" Variable-Speed Transmission

A new transmission called the "Specon MD," designed to provide infinitely variable speeds within wide ranges, is announced by the Speed Control Corporation, Department C9, Wickliffe, Ohio. The unit consists of a mechanical differential mechanism attached to a standard link-belt PIV unit. Four models are made, providing any desired speed, either forward or reverse, between 0 and 7000 R.P.M. An output torque from 20 inch-pounds at minimum speed up to 15,460 inch-pounds at maximum speed is available.

The net output horsepower varies with different models and

speeds from 1 to 20 H.P. The desired speed setting is made by a handwheel, and the speed is indicated on a large dial.77

"See-All" Thread Staging Fixture and "Normal to Helix" Thread Charts

The "See-All" thread staging fixture (Fig. 1) and the "normal to helix" thread chart (Fig. 2) are recent developments of Engineers Specialties Division of Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 8, N. Y. The staging fixture is of the universal type designed for the inspection by optical projection of screw threads ranging in diameter from 0.073 to 1.000

inch. It can be employed on practically all types of optical projection comparators in common use.

A set of twenty-five setting masters is supplied for aligning the fixture with the coordinated thread charts on the comparator. Nineteen are for use with American National form threads, and six for use with tapered threads.

The "normal to helix" thread chart is now available for those whose gaging practice requires the staging of American National form threads to the correct helix angle. Designed for use in conjunction with the "See-All" thread staging fixture, these charts are also planned for use in thread checking wherever threaded parts are held by centers and the helix adjustment is taken into account. The "normal to helix" thread chart gage screens cover the range of standard thread sizes for Class 2 and Class 3 fits. As these threads are gaged in a position normal to the helix angle, they require a corrected pitch. Consequently, a separate contour is shown for each thread size. Thus to cover the 6-32, 8-32 and 10-32 threads, three separate contours are placed on a single thread chart. The chart is designed to facilitate accurate alignment of the thread shadow with the chart contour and to check "drunken" threads and flank angles. These charts are available in magnification scales of 50X and 62.5X for thread pitches ranging from 12 to 80 in Class 2 and Class 3 fits. For pitches from 6 to 11 in both class fits, the charts are supplied at 31.25X...78

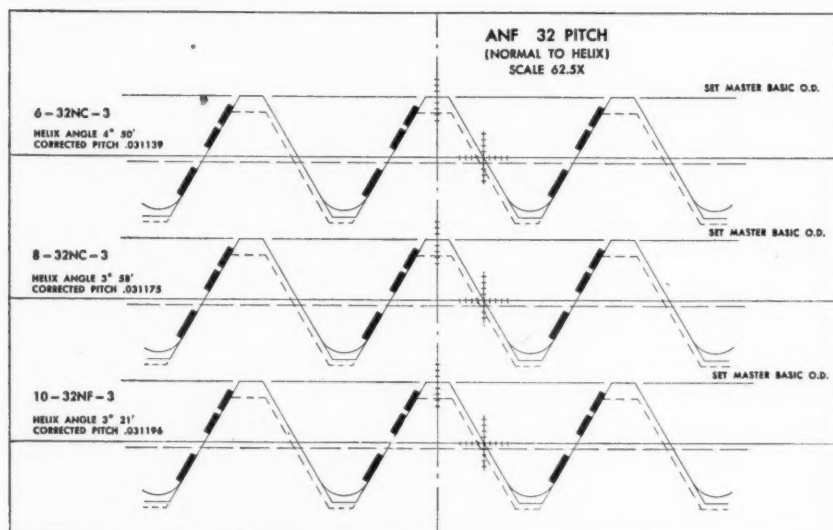
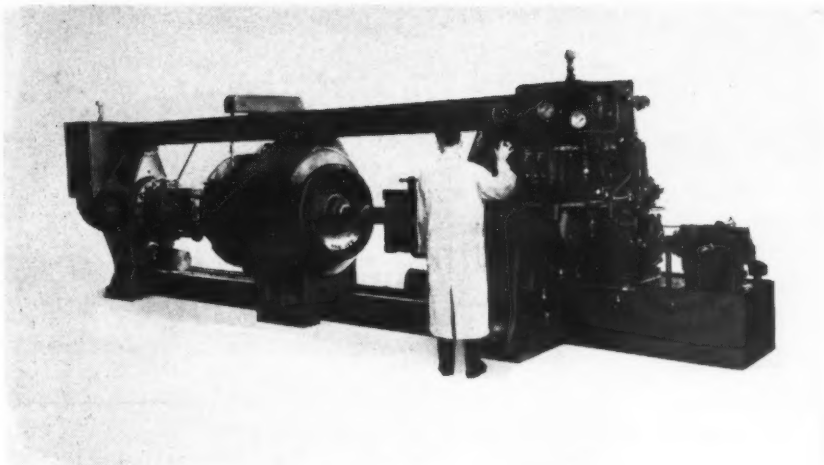


Fig. 2. "Normal to Helix" Thread Chart Developed by the Engineers Specialties Division



Locomotive and Car Wheel Double-end Mounting and Demounting Press

Watson-Stillman Double-End Locomotive and Car Wheel Mounting and Demounting Press

A production type mounting and demounting press designed for handling all types of locomotive and car wheel sets without the use of spacers has been developed by the Watson-Stillman Co., Roselle, N. J. This double-end machine, with a 54-inch clearance between bars and a stroke at each end of 26 inches, is available in 400- and 600-ton sizes. It is designed to mount Diesel wheels on a production basis without disturbing the drive gear. A special beam can also be provided for removal of passenger car wheels without subjecting the Spicer drive to pressure.

Single-station push-button controls initiate all movements of the press. Rapid traverse for idle portions of the stroke and positive overstroke protection are provided. The press can also be used for mounting car wheel and axle assemblies. Equipment includes all required gages.79

Simplex Machine for Drilling Holes in Automotive Parts

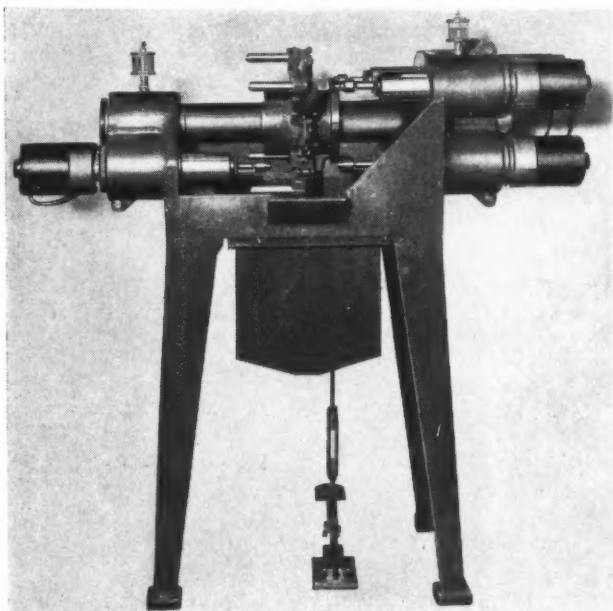
A four-way special machine has been built by the Simplex Tool Engineering Co., 2540 Park

Ave., Detroit 1, Mich., for drilling holes in automotive parts in which the center distance between holes is too close to permit the use of a conventional drill head. The parts are loaded manually in the hand-rotated, foot-indexed fixture of the machine.

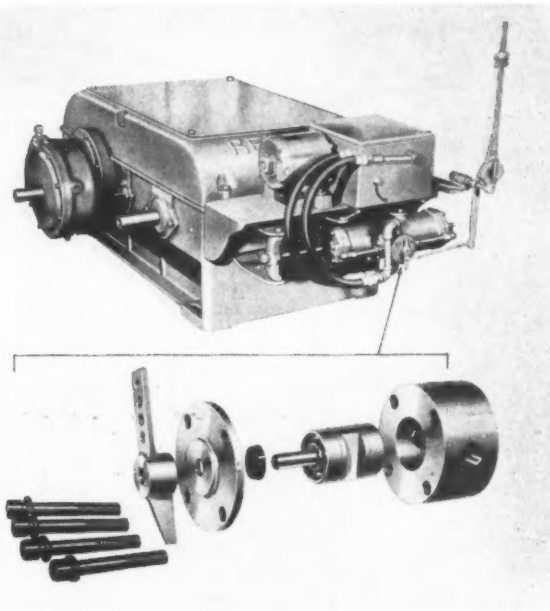
Pushing the starting button causes the four drill units to automatically feed forward, drill the four holes in the part, and return. One completely drilled part is produced at each indexing movement. The drill units can be mounted at any angle and will drill holes from No. 50 to 1/4 inch in diameter. Any desired number of units can be used for simultaneously drilling all the holes in a single part in one operation. 80

Reeves Valve for Hydraulic Controls of Variable-Speed Transmissions

A new rotary type valve designed to insure maximum operating efficiency of hydraulic controls on Reeves variable-speed transmissions is now available from the Reeves Pulley Co., Columbus, Ind. This valve permits entirely automatic speed regulation for synchronization of different machines and separate sections of a single machine. It maintains control tension and uniform peripheral winding speeds, as well as uniform pressure,



Simplex Four-way Special Drilling Machine Designed for Drilling Automotive Parts



Valve for Hydraulic Controls of Variable-speed Transmissions Made by Reeves Pulley Co.

To obtain additional information on equipment described on this page, see lower part of page 254.

New Design

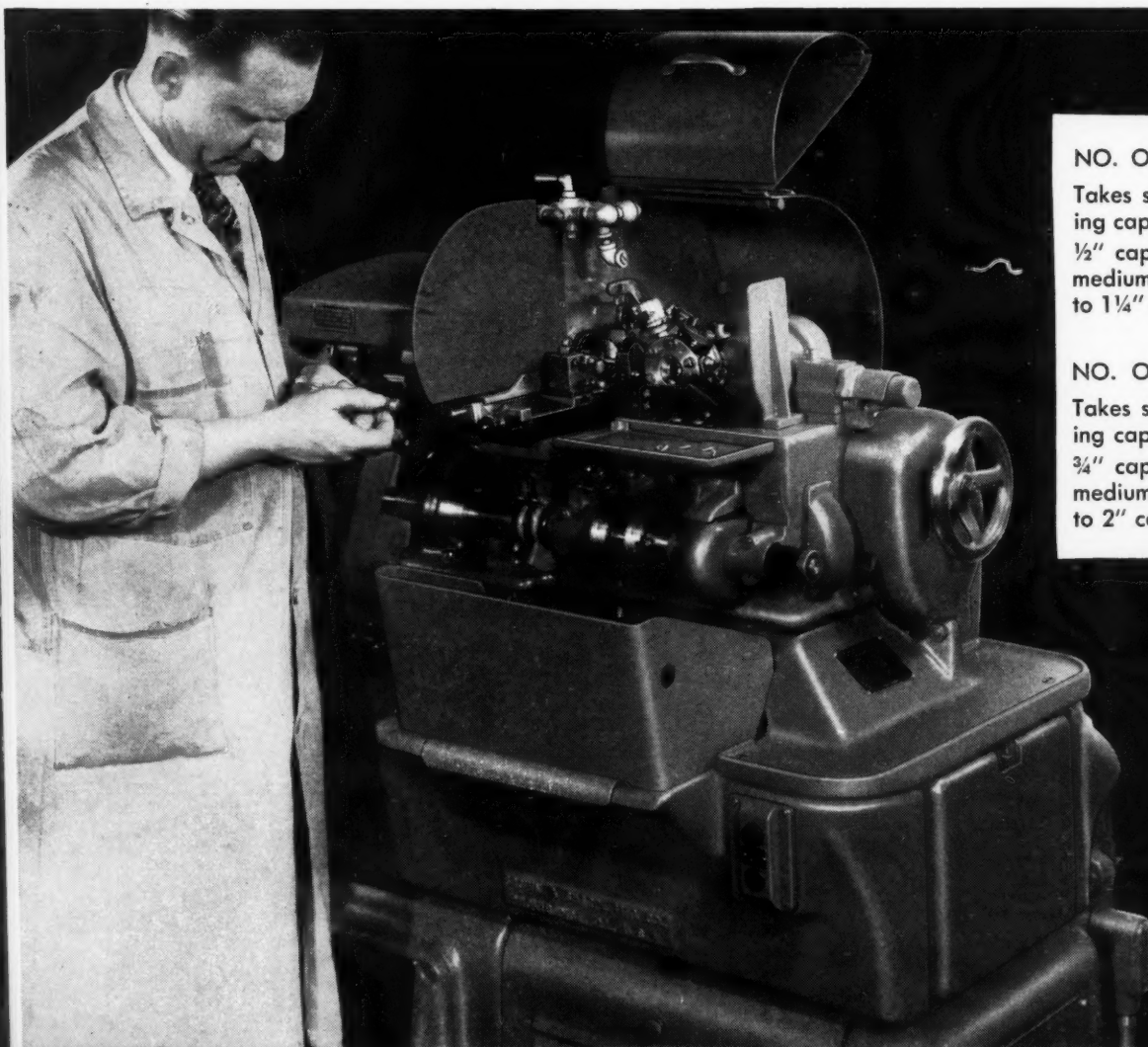
"OOG" AND "OG" AUTOMATIC SCREW MACHINES

IMPROVEMENTS AND REFINEMENTS have been made in these Automatic Screw and Automatic Cutting-Off Machines to increase their efficiency and to permit the maintenance of closer limits, finer finish and more uniform production.

Spindle is positively driven at all speeds and is provided with 196 two-speed combinations including a wide range of high to low speed ratios. This wide selection of ratios makes possible the use of correct speeds for threading without limit-

ing the selection of efficient high speeds for forming, drilling and similar operations. Equal cutting efficiency is obtained on all materials ranging from tough alloy steels to free-cutting plastics and on the widest range of work diameters.

Numerous design and construction details combine to shorten set-up time and a wide assortment of available attachments further increases overall value in terms of investment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



NO. OOG . . .

Takes stock to $\frac{3}{8}$ " diameter. Turning capacity to $\frac{3}{4}$ ".

$\frac{1}{2}$ " capacity feed tube for light to medium work, and turning capacity to $1\frac{1}{4}$ " can be furnished.

NO. OG . . .

Takes stock to $\frac{5}{8}$ " diameter. Turning capacity to $1\frac{1}{4}$ ".

$\frac{3}{4}$ " capacity feed tube for light to medium work and turning capacity to 2" can be furnished.

BROWN &

Featuring

196 two-speed combinations of spindle speeds with positive chain drive to spindle

BROWN & SHARPE											
OOG AUTO. SCREW MACHINE SPINDLE SPEEDS											
SPINDLE CHANGES GEARS	RATIO CHANGES RANGES	UPPER TORQUE	LOW SPEED	UPPER TORQUE	LOW SPEED	UPPER TORQUE	LOW SPEED	UPPER TORQUE	LOW SPEED	UPPER TORQUE	LOW SPEED
1-2	2.0	26	31	35	39	42	46	49	53	56	60
2-3	2.25	28	33	37	41	44	48	51	55	58	62
3-4	2.5	30	36	40	44	48	52	56	60	64	68
4-5	2.75	32	38	42	46	50	54	58	62	66	70
5-6	3.0	34	40	44	48	52	56	60	64	68	72
6-7	3.25	36	42	46	50	54	58	62	66	70	74
7-8	3.5	38	44	48	52	56	60	64	68	72	76
8-9	3.75	40	46	50	54	58	62	66	70	74	78
9-10	4.0	42	48	52	56	60	64	68	72	76	80
10-11	4.25	44	50	54	58	62	66	70	74	78	82
11-12	4.5	46	52	56	60	64	68	72	76	80	84
12-13	4.75	48	54	58	62	66	70	74	78	82	86
13-14	5.0	50	56	60	64	68	72	76	80	84	88
14-15	5.25	52	58	62	66	70	74	78	82	86	90
15-16	5.5	54	60	64	68	72	76	80	84	88	92
16-17	5.75	56	62	66	70	74	78	82	86	90	94
17-18	6.0	58	64	68	72	76	80	84	88	92	96
18-19	6.25	60	66	70	74	78	82	86	90	94	98
19-20	6.5	62	68	72	76	80	84	88	92	96	100
20-21	6.75	64	70	74	78	82	86	90	94	98	102
21-22	7.0	66	72	76	80	84	88	92	96	100	104
22-23	7.25	68	74	78	82	86	90	94	98	102	106
23-24	7.5	70	76	80	84	88	92	96	100	104	108
24-25	7.75	72	78	82	86	90	94	98	102	106	110
25-26	8.0	74	80	84	88	92	96	100	104	108	112
26-27	8.25	76	82	86	90	94	98	102	106	110	114
27-28	8.5	78	84	88	92	96	100	104	108	112	116
28-29	8.75	80	86	90	94	98	102	106	110	114	118
29-30	9.0	82	88	92	96	100	104	108	112	116	120
30-31	9.25	84	90	94	98	102	106	110	114	118	122
31-32	9.5	86	92	96	100	104	108	112	116	120	124
32-33	9.75	88	94	98	102	106	110	114	118	122	126
33-34	10.0	90	96	100	104	108	112	116	120	124	128
34-35	10.25	92	98	102	106	110	114	118	122	126	130
35-36	10.5	94	100	104	108	112	116	120	124	128	132
36-37	10.75	96	102	106	110	114	118	122	126	130	134
37-38	11.0	98	104	108	112	116	120	124	128	132	136
38-39	11.25	100	106	110	114	118	122	126	130	134	138
39-40	11.5	102	108	112	116	120	124	128	132	136	140
40-41	11.75	104	110	114	118	122	126	130	134	138	142
41-42	12.0	106	112	116	120	124	128	132	136	140	144
42-43	12.25	108	114	118	122	126	130	134	138	142	146
43-44	12.5	110	116	120	124	128	132	136	140	144	148
44-45	12.75	112	118	122	126	130	134	138	142	146	150
45-46	13.0	114	120	124	128	132	136	140	144	148	152
46-47	13.25	116	122	126	130	134	138	142	146	150	154
47-48	13.5	118	124	128	132	136	140	144	148	152	156
48-49	13.75	120	126	130	134	138	142	146	150	154	158
49-50	14.0	122	128	132	136	140	144	148	152	156	160
50-51	14.25	124	130	134	138	142	146	150	154	158	162
51-52	14.5	126	132	136	140	144	148	152	156	160	164
52-53	14.75	128	134	138	142	146	150	154	158	162	166
53-54	15.0	130	136	140	144	148	152	156	160	164	168
54-55	15.25	132	138	142	146	150	154	158	162	166	170
55-56	15.5	134	140	144	148	152	156	160	164	168	172
56-57	15.75	136	142	146	150	154	158	162	166	170	174
57-58	16.0	138	144	148	152	156	160	164	168	172	176
58-59	16.25	140	146	150	154	158	162	166	170	174	178
59-60	16.5	142	148	152	156	160	164	168	172	176	180
60-61	16.75	144	150	154	158	162	166	170	174	178	182
61-62	17.0	146	152	156	160	164	168	172	176	180	184
62-63	17.25	148	154	158	162	166	170	174	178	182	186
63-64	17.5	150	156	160	164	168	172	176	180	184	188
64-65	17.75	152	158	162	166	170	174	178	182	186	190
65-66	18.0	154	160	164	168	172	176	180	184	188	192
66-67	18.25	156	162	166	170	174	178	182	186	190	194
67-68	18.5	158	164	168	172	176	180	184	188	192	196
68-69	18.75	160	166	170	174	178	182	186	190	194	198
69-70	19.0	162	168	172	176	180	184	188	192	196	200
70-71	19.25	164	170	174	178	182	186	190	194	198	202
71-72	19.5	166	172	176	180	184	188	192	196	200	204
72-73	19.75	168	174	178	182	186	190	194	198	202	206
73-74	20.0	170	176	180	184	188	192	196	200	204	208
74-75	20.25	172	178	182	186	190	194	198	202	206	210
75-76	20.5	174	180	184	188	192	196	200	204	208	212
76-77	20.75	176	182	186	190	194	198	202	206	210	214
77-78	21.0	178	184	188	192	196	200	204	208	212	216
78-79	21.25	180	186	190	194	198	202	206	210	214	218
79-80	21.5	182	188	192	196	200	204	208	212	216	220
80-81	21.75	184	190	194	198	202	206	210	214	218	222
81-82	22.0	186	192	196	200	204	208	212	216	220	224
82-83	22.25	188	194	198	202	206	210	214	218	222	226
83-84	22.5	190	196	200	204	208	212	216	220	224	228
84-85	22.75	192	198	202	206	210	214	218	222	226	230
85-86	23.0	194	200	204	208	212	216	220	224	228	232
86-87	23.25	196	202	206	210	214	218	222	226	230	234
87-88	23.5	198	204	208	212	216	220	224	228	232	236
88-89	23.75	200	206	210	214	218	222	226	230	234	238
89-90	24.0	202	208	212	216	220	224	228	232	236	240
90-91	24.25	204	210	214	218	222	226	230	234	238	242
91-92	24.5	206	212	216	220	224	228	232	236	240	244
92-93	24.75	208	214	218	222	226	230	234	238	242	246
93-94	25.0	210	216	220	224	228	232	236	240	244	248
94-95	25.25	212	218	222	226	230	234	238	242	246	250
95-96	25.5	214	220	224	228	232	236	240	244	248	252
96-97	25.75	216	222	226	230	234	238	242	246	250	254
97-98	26.0	218	224	228	232	236	240	244	248	252	256
98-99	26.25	220	226	230	234	238	242	246	250	254	258
99-100	26.5	222	228	232	236	240	244	248	252	256	260



196 TWO-SPEED COMBINATIONS

are provided with a range from 6050 to 50 R.P.M. on the "OOG," and a range of 4230 to 35 R.P.M. on the "OG." Approximate ratios of high to low speeds range from 1.6:1 to 13:1 except for highest and lowest high speeds where ratios range from 1.6:1 to 11:1.

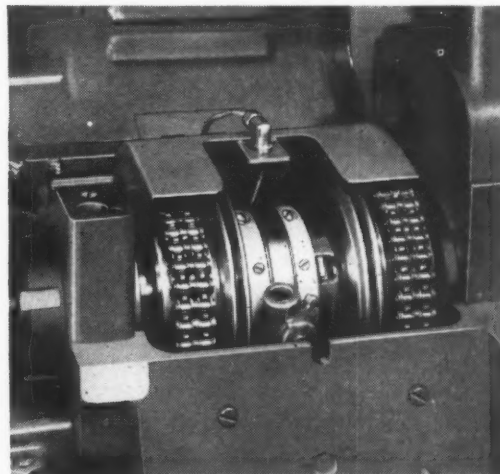


LOW SPEED RATIO AND DIRECTION

equally easy to change. Selecting the direction of low speed is done merely by placing lower of two change gears on proper one of two centers. Driving sprockets and spindle driving chains remain untouched.

HIGH SPEEDS EASILY CHANGED

by one pair of pick-off gears. Gears quickly withdrawn from splined shafts by loosening clamp nuts, releasing washers. Replaced by another set from storage compartment in door. One set of 16 gears provides not only 16 high speeds, but also all ratio changes.



CHAIN-DRIVEN FULL-

weight, liquid level, temperature, and other variable elements. The valve can be actuated by a pressure of 4 ounces.

This rotary type valve is now installed on all new Reeves variable-speed transmissions, replacing the stem type valve previously used. It is also available for replacement on transmissions in service. Only two sizes of valves are required to fit all Reeves transmissions using hydraulic controls. 81

Bowen Face Grinder

Bowen Grinders, Inc., 1607 Crescent Drive, Beloit, Wis., is manufacturing surface grinders of an entirely new design on which several fixtures holding different types of work can be mounted around a central column. With this arrangement, work in any one of the fixtures can be ground while the other fixtures are being loaded or unloaded. This grinder has been made in sizes from 1/2 H.P. with a 4-inch grinding wheel up to 15 H.P. with a 14-inch wheel, the latter size being shown in the illustration. It can be made in many sizes, however, and can be used to take either face or shear cuts. The fixtures are mounted in a horizontal position.

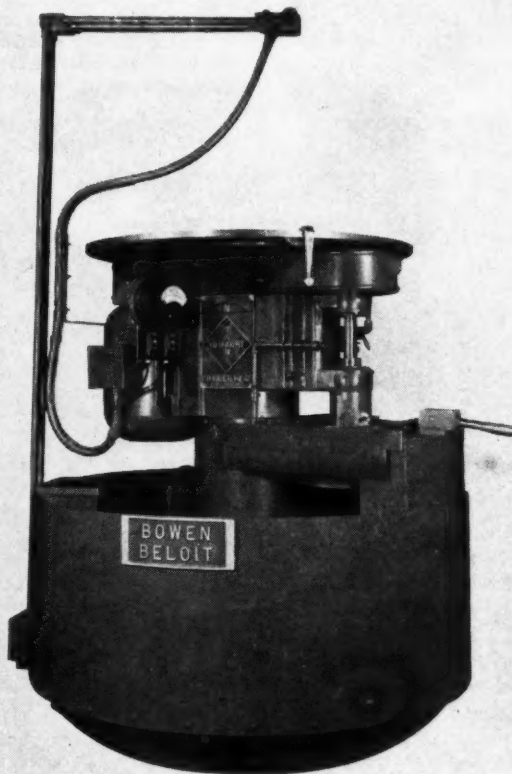
The ring type grinding wheel employed is mounted on a balanced unit consisting of a motor, master bearing, and spindle head. This balanced unit, with the motor at one side of the column and the spindle head at the opposite side, is free to rotate or be held at any fixed position around the large hollow vertical column. The column serves only as a guide for the vertical movement of the balanced unit, which is supported by a ball thrust bearing on a micrometer feed-screw. The feed-screw is centered in the hollow column and controls the height or vertical position of the grinding wheel by feeding the balanced unit up or down. The vertical feed can be operated while the grinding wheel is either stationary or moving.

Fixtures can be furnished for holding a wide variety of work,

including bars or straight pieces having lengths equal to approximately twice the diameter of the grinding wheel. Typical operations performed on this machine include grinding the split faces on connecting-rods and connecting-rod caps, connecting-rod side faces, and clutch plates. A clear height of 24 inches or more is available under the grinding wheel for fixtures and work.82

General Electric Phase-Sequence Indicator

A phase-sequence indicator designed for a wide range of applications in the manufacturing, industrial, and central station fields has been developed by the Gen-



Bowen Face Grinder with Grinding Head Mounted on Balanced Unit Designed to Rotate or Oscillate about a Central Column Around which Several Work-holding Fixtures can be Mounted



General Electric Phase-sequence Indicator

eral Electric Co., Schenectady 5, N. Y. This new indicator is without moving parts, bearings, or pivots. It can be used to predict the directional rotation of poly-phase meters for machine drives, elevators, and air-conditioning equipment; to determine the proper connections for paralleling generators, transformer banks, and power buses; to determine proper connections for watt-hour meters, reactive-component meters, power factor meters, KVA meters, reverse-power relays, and phase-sequence relays; to check vacuum-tube, thyatron, rectifier, and inverter installations; and to study vector relations of poly-phase circuits and various other electrical problems. 83

Printed Cellophane Tape for Identifying Parts

Pressure-sensitive, single-ply and laminated cellophane and acetate fiber tape in different colors, with names or notations printed to order, is now being supplied to industrial plants by the Topflight Tape Co., Division of Topflight Tool Co., Inc., York, Pa. This tape is being used to mark parts, tool steel, and fluid lines. It is also used for instruction labels and many other purposes. The tape provides a convenient means for quickly applying identification marks or instructions on any material or part.84

Millions of cuts . . .

with the NEW **CINCINNATI TOOL LIFTER**

DURABLE

The Cincinnati Tool Lifter, a new development, operates millions of times without a fault. A successful tool lifter must be certain in action on each stroke to prevent tool damage. It must *continue* to be certain month after month, year after year, for millions of operations. The Cincinnati Tool Lifter, with positive return as well as positive lift, is outstandingly successful.

VERSATILE

Efficient at high speeds or low, long strokes or short—dependable at different positions or angular settings of tool slide—or clapper box, the Cincinnati Tool Lifter is truly versatile and productive.

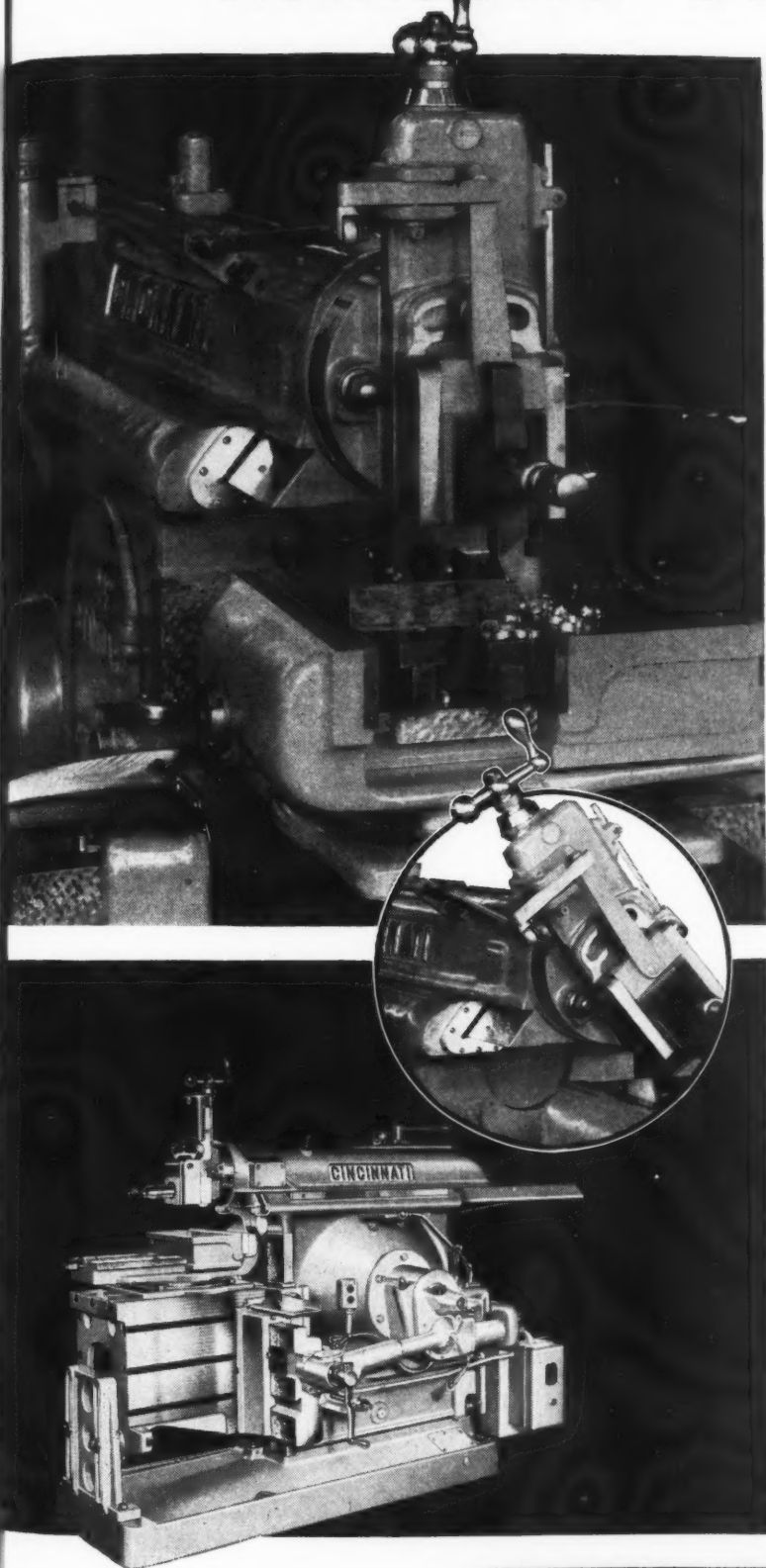
AUTOMATIC

It relieves operators and greatly increases speed of cutting. After simple setting it is automatic.

SPEEDY

Carbide and high-speed cutting tools both operate to greater advantage when protected by a Cincinnati Tool Lifter.

Write for Catalog N-3.



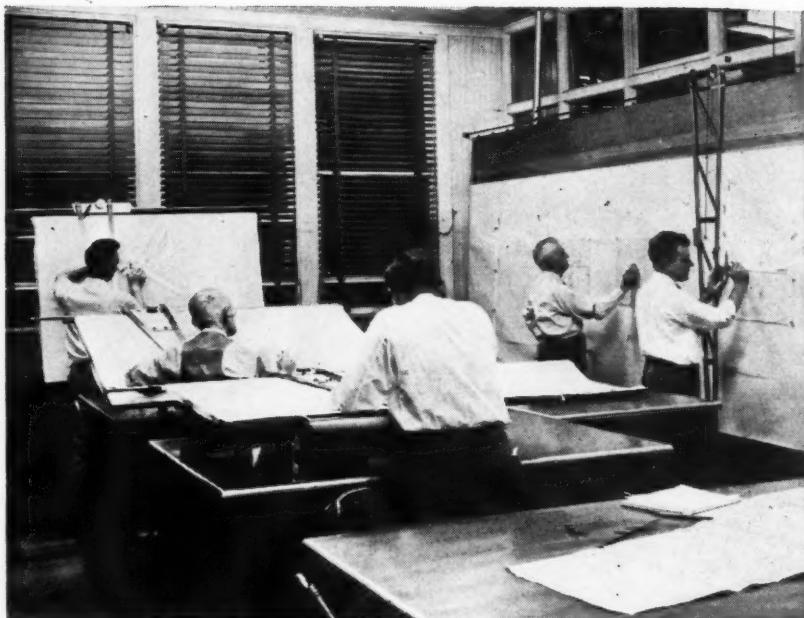
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Stainless-Steel Drafting Machines and Adjustable Drawing-Boards

A new stainless-steel drafting machine designed for any size or make of drawing-board is shown in use on horizontal and vertical boards in the accompanying illustration. This drafting machine is made by the Emmert Mfg. Co., Waynesboro, Pa., in models adapted for thirteen different sizes of drawing-boards ranging in width from 24 to 132 inches and of any length. Vertical, counterbalanced, drafting-board units for work up to 11 feet in height by any length desired, as well as draftsmen's desk units and horizontal-vertical, counterbalanced, adjustable-board units, are also available. 85



Horizontal-vertical Drawing-boards Equipped with Emmert Stainless-steel Drafting Machines

"Sureweld" Alternating-Current Welding Machine

An alternating-current welder known as the "Sureweld" has been brought out in twelve models by the National Cylinder Gas Co., 840 N. Michigan Ave., Chicago 11, Ill. Seven of the models are adapted for high-speed, heavy-duty fabrication welding, and the other five are intended for use in garages, repair shops, machine shops, welding shops, or wherever light production welding work is

done. A stepless, full-range output control is provided to give the exact welding heat required for efficient operation. 86

Ipsen Automatic Heat-Treating Unit

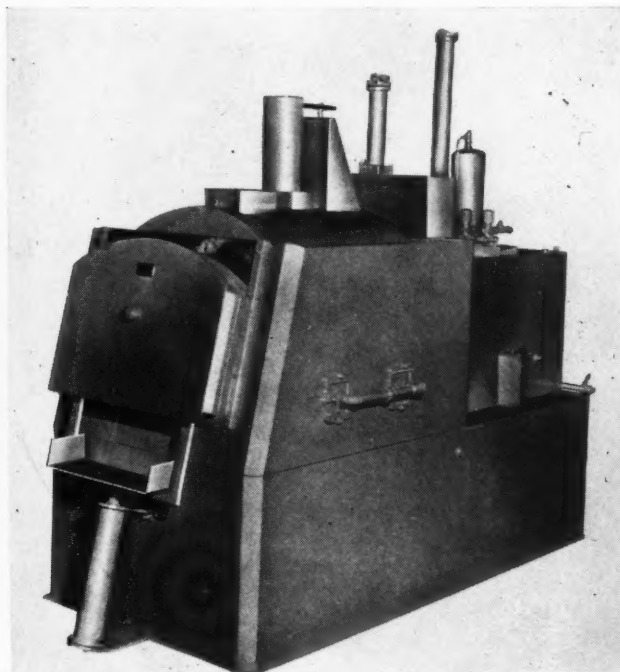
A line of automatic heat-treating units, designed to fit into existing plant production lines, has been brought out by Ipsen

Industries, Inc., 311 Blackhawk Bldg., Rockford, Ill. These units consist of a batch-loading automatic furnace connected and sealed to an automatic quenching tank.

In operation, a tray of parts is placed in the furnace. The operator sets one timer for the heating cycle and another timer for the quenching or cooling time. A selector switch for either oil quenching or air cooling is also

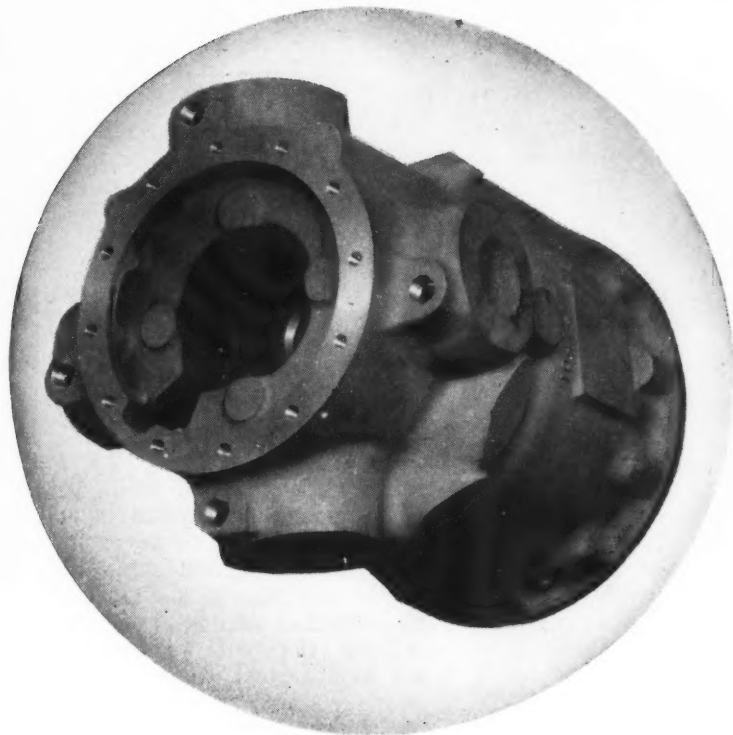


"Sureweld" Alternating-current Welder



Ipsen Automatic Heat-treating Unit

One a minute-

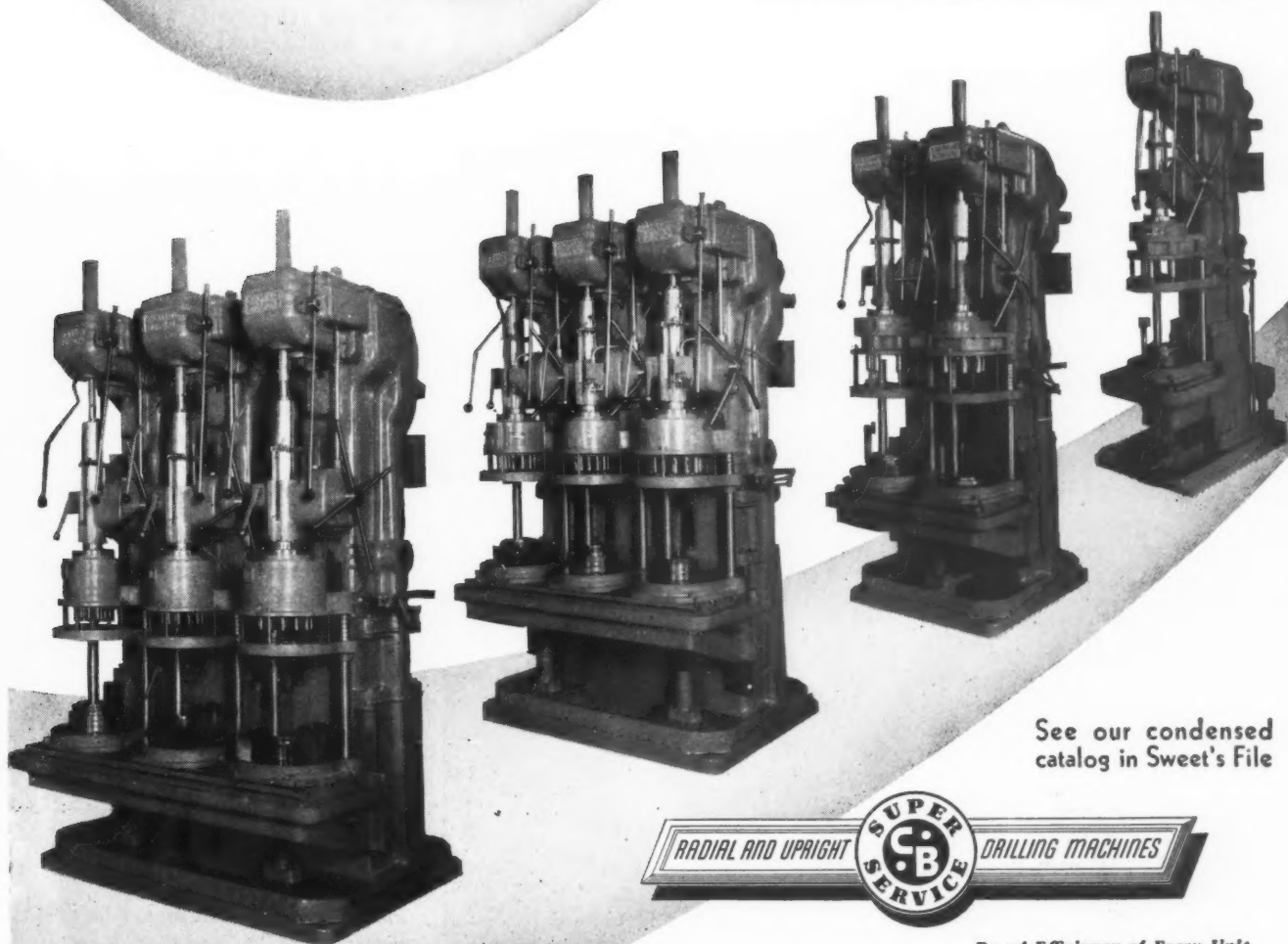


This battery of highly productive 21" and 24" Cincinnati Bickford Super Service Direct Drive Drills is drilling 24—.257" holes; tapping 24— $\frac{5}{16}$ " holes; step drilling 4— $\frac{13}{32}$ " x $\frac{7}{16}$ " diameter holes $1\frac{5}{8}$ " deep; tapping 4— $\frac{5}{8}$ " holes in this crank case housing.

The operations are performed on both ends of three sizes of castings. All operations are completed at the rate of one a minute.

These Direct Drive Drilling Machines are made in the following sizes: 21" with 3 or 4 horsepower motor; 24" with 5 or 7½ horsepower motor; 28" with 7½ or 10 horsepower motor.

Write for Booklet U-27 for complete description.



See our condensed catalog in Sweet's File



Equal Efficiency of Every Unit
Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

MACHINERY, November, 1948—241

set. Pressing a button then starts automatic processing of the work.

Typical parts heat-treated in an atmosphere in this furnace are shafts, gears, springs, tools, and dies, machine parts, stampings, etc. This unit is available in two sizes having capacities for handling 250 and 500 pounds of work per hour. The maximum operating temperature is 1750 degrees F. for both machines. The hearths of the machines are 24 by 36 inches and 32 by 48 inches. 87

Air Filter and Automatic Air-Line Lubricator

A micron type filter for removing moisture, emulsified oil, grit, scale, and other impurities from compressed air supplied to air-operated equipment, such as air tools and cylinders, has been developed by the Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill. In this filter (Fig. 1), air enters the bowl through spiral baffles that cause it to swirl in a circular path, throwing off impurities toward the wall of the bowl. Thus most of the solid and liquid impurities drop to the base of the bowl. The impurities that do not drop to the bottom are removed at the outer edges of the filter cartridge by a method known as "edge filtration" when the air passes between the layers of the cartridge. Action of the filter is visible through a large plastic bowl.

Another new product announced by this company is the automatic air-line lubricator seen in Fig. 2. This device was developed for installation on lines serving com-

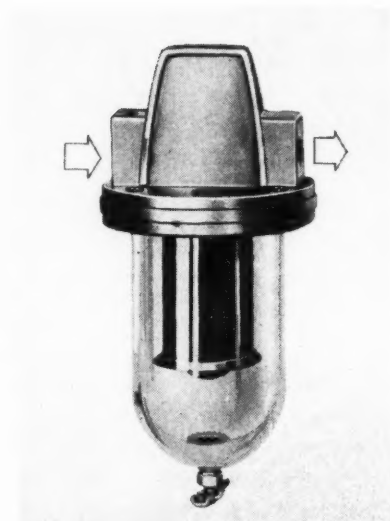


Fig. 1. Hannifin Micronic Type Air Filter

pressed-air operated tools and equipment. The lubricator meters the oil into the air stream in the form of a fine mist, which reduces friction and heat and prolongs the life of the equipment.88

Tungsten-Carbide Welding Rods

The American Manganese Steel Division of the American Brake Shoe Co., Department 647, 230 Park Ave., New York 17, N. Y., has announced two new tungsten-carbide welding rods for reclamation and hard-facing applications, designated "Tube Tungsit" and "Tungrod." "Tube Tungsit" consists of tungsten-carbide particles, of various screen sizes, encased in a steel tube. When applied as a welding rod, the steel tube melts, forming a molten matrix. Since the particles of

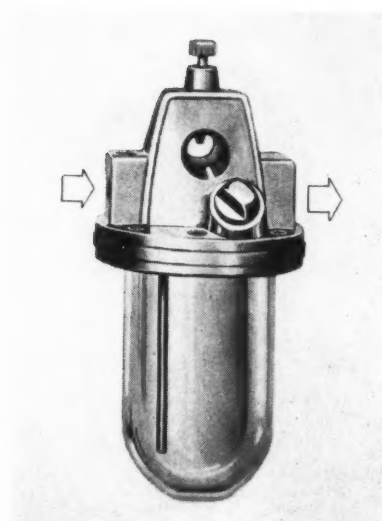
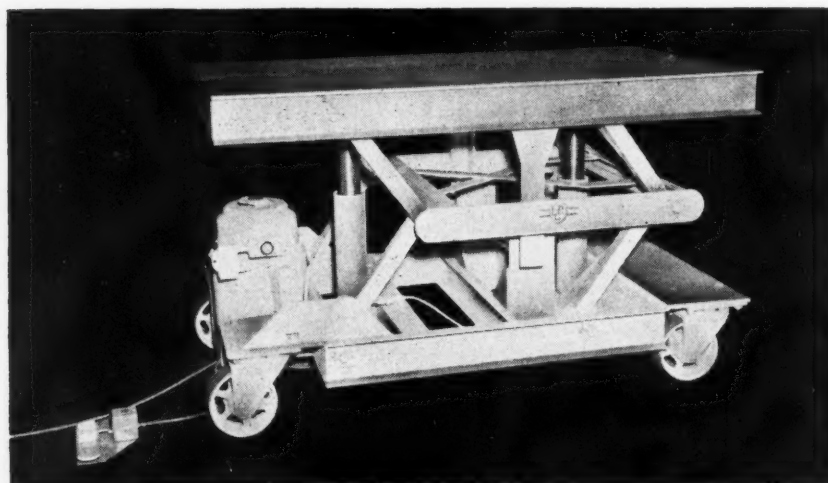


Fig. 2. Hannifin Automatic Air-Line Lubricator

tungsten carbide have an extremely high melting point, they do not melt, but remain in suspension. As 50 to 60 per cent of the deposit is of extremely hard tungsten-carbide particles, rapid solidification occurs, which distributes the particles evenly in the weld deposit, thus forming a wear-resistant surface. "Tube Tungsit" is available in two types for oxy-acetylene and electric application. It is recommended for applications where severe abrasion occurs and where highly efficient cutting qualities are needed.

"Tungrod" differs from "Tube Tungsit" in that the "Tungrod" particles are 40 screen size and finer, while "Tube Tungsit" particles range from 5 to 40 screen size. "Tungrod" is supplied in two types—bare for oxy-acetylene applications, and coated for electric applications. 89



Lyon-Raymond Hydraulic Elevating Type Sheet-Feeding Table

Sheet-feeding table of 10,000 pounds capacity with hydraulically operated elevating movement of 16 inches. Top of table is 36 inches wide by 66 inches long. Side extensions can be provided to increase the width to 48 inches, and end extensions to increase the length to 96 inches. The table has a lowered height of 26 inches and an elevated height of 42 inches. Can be loaded in a storage area and moved into place by an industrial power truck for which a



How much do MACHINE MINUTES cost you?

Figure your machining speeds—your operator time—your daily requirements—and your down-time. It will show you why more and more smart production men are turning to the No. 12 Hydraulic for a consistent volume of work.

GISHOLT No. 12 HYDRAULIC AUTOMATIC LATHE

These are important factors in cutting the cost of machine minutes—and in cutting the unit cost of many parts.

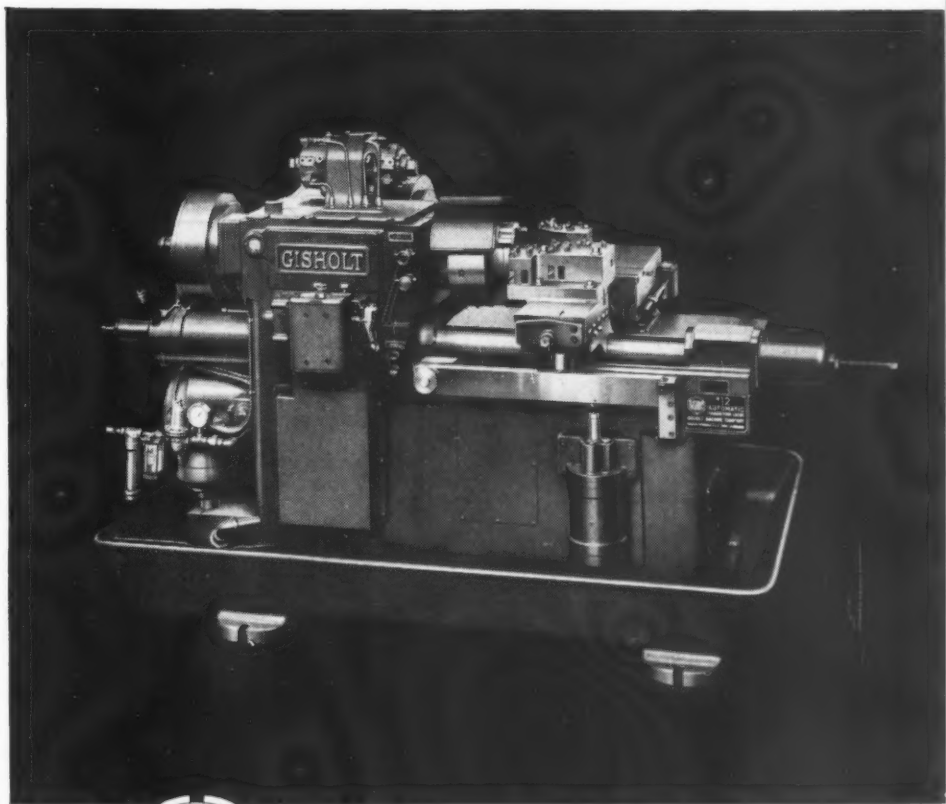
Easier Job Set-ups—No cams or drums. All adjustment points for slide control are conveniently placed between shoulder and knee levels—open and accessible. Tool blocks and tool bits are simple to position. There's no time lost here.

Faster Machining—This advanced automatic lathe has the speed and ruggedness for the toughest high production work.

Easy to Operate—One operator can tend two or more machines. Tool bits are quickly adjusted or replaced during runs.

Simple Construction—There are fewer parts requiring adjustment or replacement. You expect less and have less down-time with the No. 12 Hydraulic. Write for the catalog—Form 1104A.

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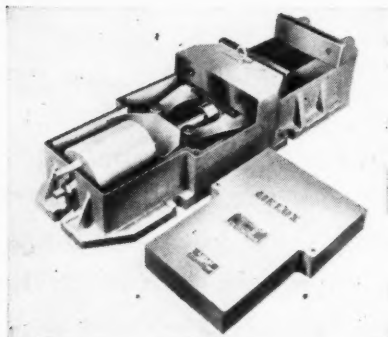
THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

towing eye is provided. The table illustrated is equipped with optional 3/4 H.P. motor-driven pump having a foot-operated switch. Introduced by Lyon-Raymond Corporation, 6212 Madison St., Greene, N. Y.90

Airlox Pneumatic Vise

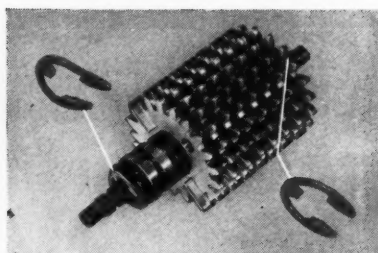
Pneumatic vise designed primarily for holding production work on 40- to 50-H.P. milling machines. This vise has a gripping power ratio of 200 to 1, which provides a grip of



10 tons on the work when operated from an air-line having a pressure of 100 pounds per square inch. It is so designed, however, that an air-line pressure of 200 pounds can safely be used if a higher jaw pressure is desired. The length of the vise is 45 inches, width 13 1/8 inches, height 8 3/4 inches, and weight 575 pounds. The jaws have a width of 10 1/2 inches and a depth of 3 inches. The maximum opening between the jaws is 12 inches. Brought out by Production Devices Inc., Whitehall, N. Y.91

"Truarc" Bowed "E" Ring for Positioning Gears on Shaft

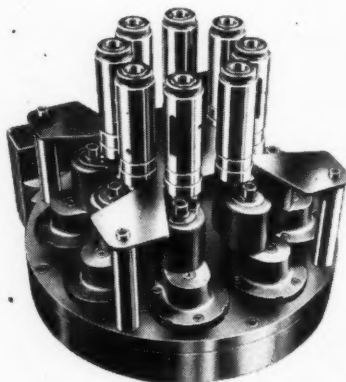
An improved method of assembly that assures accurate positioning of a series of gears and spacers on a shaft used in counter gear assemblies of business machines has been made possible through the development of the new "Truarc" bowed "E" retaining ring shown in the upper left-hand corner of the illustration. This three-prong ring, bent like a bow out of its plane at about its horizontal center line to a degree corresponding to the maximum end play allowed, takes up any clearance or end play in the assembly and yet has sufficient resiliency to permit the gears to turn freely. A standard "Truarc" ring, such as shown in the



lower right-hand corner of the illustration, is used at the right-hand end of the shaft to retain the gears. These rings are manufactured by Waldes Kohinoor, Inc., Long Island City 1, N. Y.92

Heavy-Duty Multiple Drill Head with Adjustable Spindles

One of a new heavy-duty series of multiple adjustable-spindle drill heads announced by Strutz & Mead, Inc., Milwaukee 2, Wis., national sales representatives for the Wisconsin

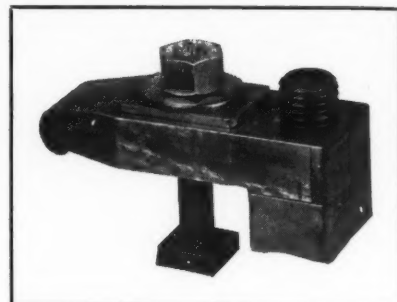


Drill Head Co. This series rounds out the "Kwick-Change" line made by the Wisconsin Drill Head Co. It is made in two- to eight-spindle models. The bolt circles in the two-spindle head range from 2 3/16 to 14 63/64 inches in diameter, and in the eight-spindle head from 7 31/64 to 20 17/64 inches in diameter. These heads will drill holes up to 1 1/4 inches in diameter in cast iron. They are equipped with No. 3 Morse taper spindles having a 1-inch vertical drill adjustment.93

La Placa Adjustable Clamp

Self-contained, adjustable clamp designed to hold plain or irregular work securely on lathe faceplates, jig borer tables, shaper platens, or the tables of planers and milling ma-

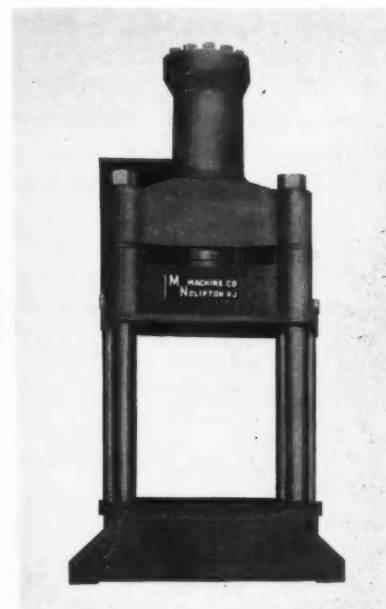
chines. Developed and placed on the market by the La Placa Tool & Die Co., P. O. Box 486, Bridgeport, Conn. This clamp is adjustable for different sizes of work and requires no shims. Can be easily removed or applied. It is made in three sizes



having strap lengths of 3, 4, and 5 1/2 inches. Adjustment for height ranges from 1/2 inch to 2 1/2 inches.94

M & N Basic Press

Basic press adaptable for forming, drawing, and stamping. Built in any size or capacity to meet specific production requirements by M & N Machine Tool Works, Inc., 157 Orono St., Clifton, N. J. Available in platen sizes of 10 by 10 or 36 by 36 inches. The downward platen pressure capacity is 200 tons, and the upward platen pressure 50 tons. The stroke is 20 inches; height of opening 40 inches; and working pressure 3000 pounds per square inch. Occupies a floor space of 52 by 52 inches. The pump and motor are built to suit requirements. .95



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Very often the investment in CRUSHTRUE Devices for standard surface grinders will pay for itself in 30 days.

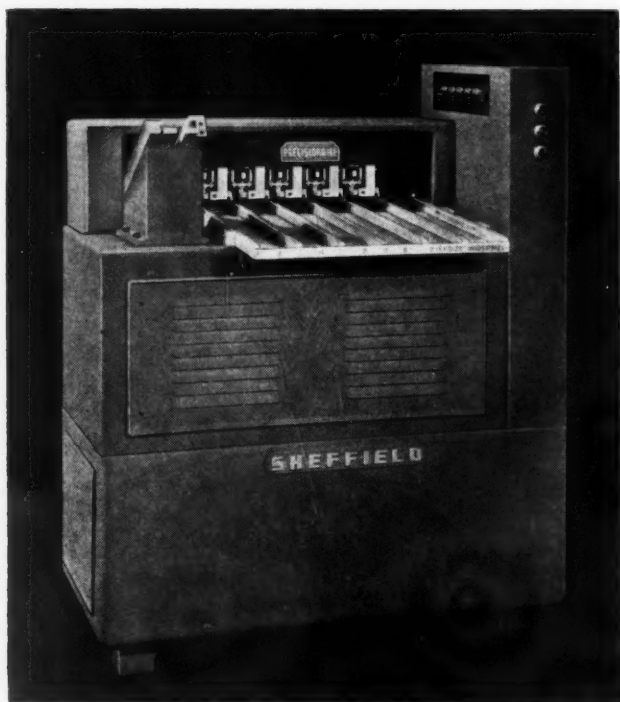
It will cost you nothing to find out about this method. Send us the prints of the work you contemplate and a list of your grinding equipment. We will then give you an estimate of whatever additional equipment you will need. Or—write for Representative to call at your plant.

Thread and Form Grinders, Microform and Visualform Grinders, Gear Chamfering, Burring and Burnishing Machines, Crushtrue Rolls and Fixtures, Special Machine Tools.

CRUSHTRUE HEADQUARTERS

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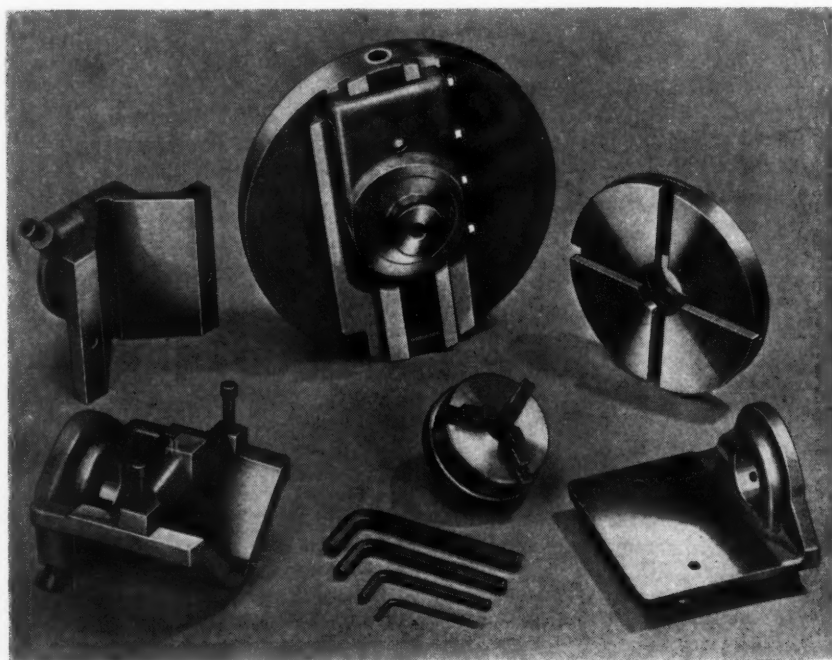
Sheffield Piston-Pin Checking Machine

Machine for automatically checking the average diameter of piston-pins and automatically segregating the pins into six classifications. The pins are manually loaded into a chute which has a "No Go" gaging fixture that prevents over-size parts from being accepted. The accepted parts are fed by gravity into a locating vee, from which they are transferred to an air-gaging ring by a motor-driven arm. The pins are checked by air jets in the ring which operate Sheffield "Airlectric" heads. These, in turn, actuate solenoids which open and close trap doors to the segregating chutes. The pin is pushed through the air ring by the next piston-pin to be checked. The handling rate is about 2400 pins per hour. Developed by the Sheffield Corporation, Dayton 1, Ohio.96



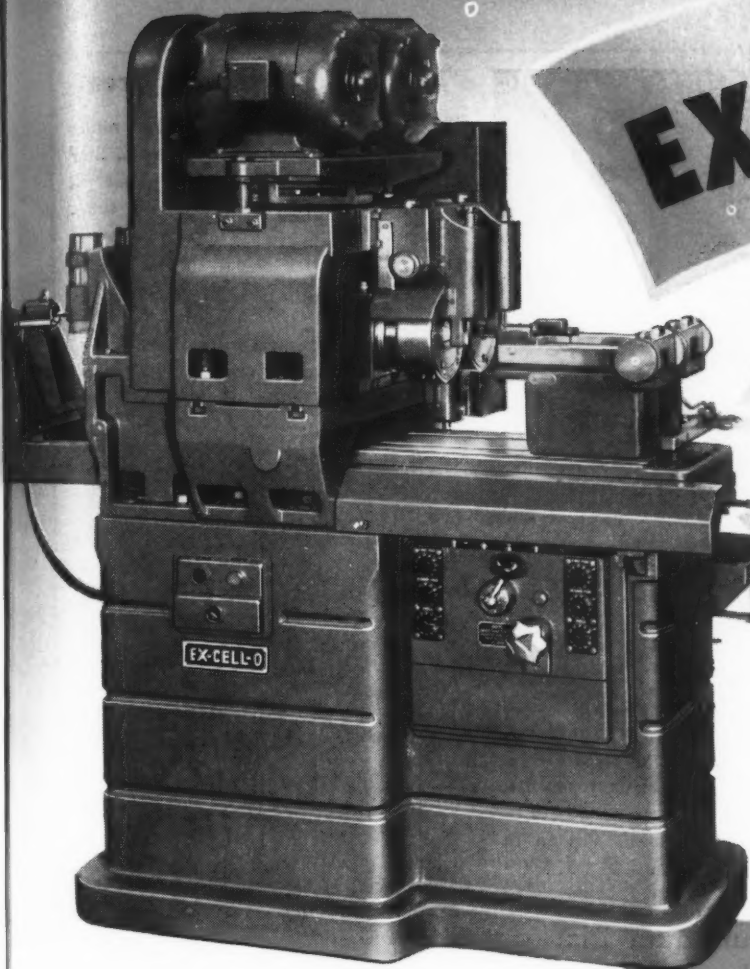
Wilmotte "Visi-Limit" Micrometer

Electronic instrument capable of accurately measuring an object while it is moving rapidly, as well as vibrating, and without making contact with the object measured. This instrument, known as the "Visi-Limit" micrometer, can measure to an accuracy of plus or minus 0.0001 inch, and can be used to obtain automatic control over manufacturing processes. The instrument is designed especially for measuring the diameter of wire and tubing and the width of strip material. It can be modified to permit measuring the thickness of sheet material or the dimensions of certain machined or punched parts, and for routine production testing of several dimensions simultaneously. Announced by Raymond M. Wilmotte Inc., 1469 Church St., N.W., Washington 5, D. C.97



"Multi-Purpose" Faceplate and Attachments

Multi-purpose faceplate and lathe attachments by means of which a lathe can be quickly and easily converted for milling, boring, or drilling operations. Time-consuming set-ups are not necessary in making the changes for different types of work. Bar stock or castings can be drilled, bored, milled, or ground. Operations at any radial or angular positions can be performed without moving the work from its original position in the fixture. In addition to the faceplate and adapter, the attachments consist of a vertical V-block, an auxiliary T-slot faceplate, a three-jaw chuck, an angle-plate, and a horizontal V-block with clamp. Made by the Superior Mfg. Co., Department N, 1302 Ontario St., Cleveland 13, Ohio.98



EX-CELL-O

CAN GIVE YOU

MORE ECONOMICAL

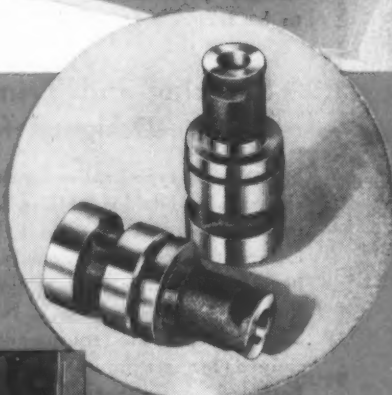
PRODUCTION

THIS ENTIRELY AUTOMATIC PRECISION BORING MACHINE IS TYPICAL OF EX-CELL-O SUPERIORITY IN ENGINEERING

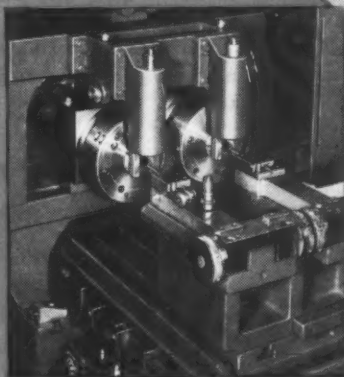
● Here's a machine that receives automotive valve guide bushings from a conveyor line, rough and finish bores them and delivers them to another conveyor, all automatically. The bushings, 2-3/16" long with 11/32" bores, enter chutes at the left end of the spindles, are fed through hollow spindle shafts to chucks, are located, clamped, rough and finish bored and ejected at the rate of 300 pieces per hour. Bores are held to a tolerance of .001". The operator need never touch the parts except to inspect the bores occasionally.

The engineering know-how that makes possible an automatic machine such as this one is always available to Ex-Cell-O customers, whether their work requires parts in short runs or great volume. Whether tolerances are measured in thousandths or ten-thousandths, Ex-Cell-O engineers will suggest the most practical and efficient method of finishing your parts. Call Ex-Cell-O today!

Above: Full view of Ex-Cell-O Style 2112-A Precision Boring Machine arranged for automatic rough and finish boring of valve guide bushings. Parts enter chutes at left end of spindles, are fed through hollow spindle shafts to chucks, are rough and finish bored and ejected, all automatically, at the rate of 300 pieces per hour.



Above: Automotive valve guide bushings with 11/32" holes, 2-3/16" long that are rough and finish bored on the machine shown above left.



Left: Close-up view of spindles and boring bar supports. Vertical castings in front of chucks house locating plungers that, when lowered, limit the forward travel of the bushings. Locators are withdrawn during boring and ejecting portions of cycle. Graduated dials on boring bar supports permit accurate adjustment of boring bar to control size of hole.

EX-CELL-O

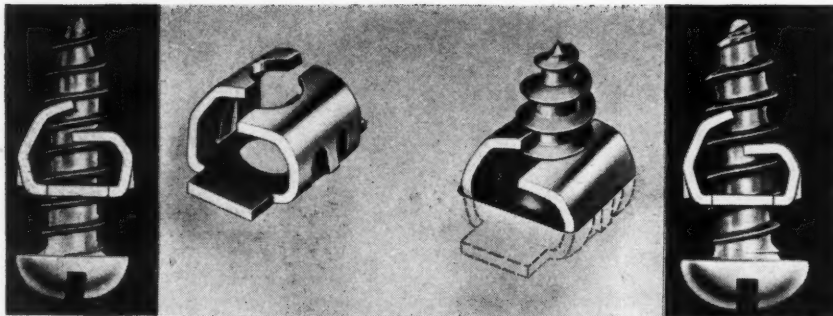
CORPORATION

DETROIT 32, MICHIGAN

48-36



Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles • Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts



"Snap Nut" for Sheet-Metal Assemblies

Spring-steel "snap nut" which can be quickly snapped into place in 9/32-inch square holes punched in sheet-metal panels 0.037 to 0.055 inch thick. The nut is simply placed in the assembly position from the front side of the work, instead of from the rear side. As the screw is driven, the arched spring arms of the nut expand just enough to permit entry of the screw, locking the fastener to the inner panel and at the same time binding against the root of the screw thread, permitting the outer panel to be securely fastened in place.

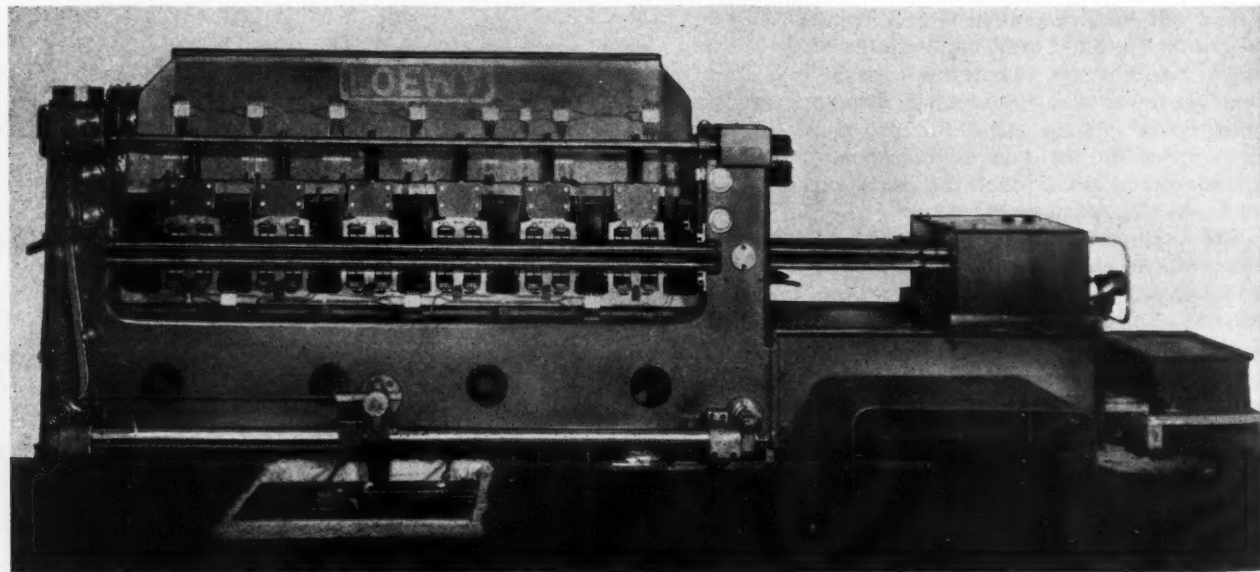
This fastener will accommodate a No. 8 sheet-metal screw, as shown in the view at the left, and a No. 10 screw, shown at the right. The larger size screw merely expands the spring arms further. It will withstand a tightening torque of 35 to 45 inch-pounds.

The new nut is particularly suited for blind assemblies on automobiles, radios, refrigerators, stoves, heaters, and other mass production products. Manufactured by Prestole Corporation, 3138 Bellevue Road, Toledo 6, Ohio. 99

Shearing and Trimming Line for Aluminum Plate Designed for Maximum Production

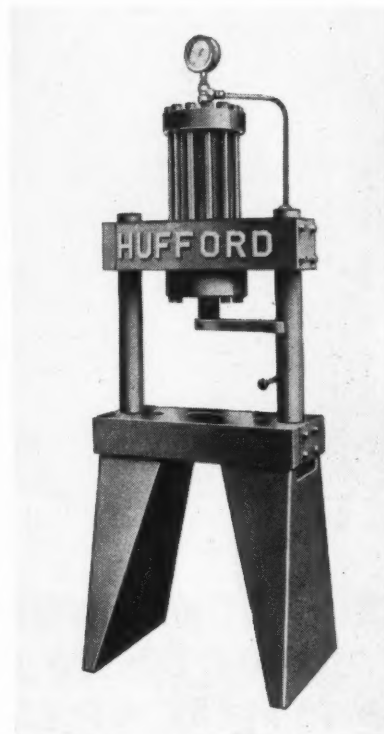
Backed-up type roller-leveler of a shearing and trimming line for aluminum plate designed and built by Loewy Construction Co., Inc., Rolling Mill Division of Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y. This equipment is arranged for maximum production of flattened, edge-sheared, and cut-to-length plate. There are two lines in the complete installation, one having

a capacity for plates 1/2 inch by 104 inches by 33 feet, and the other for plates of 0.200 inch by 104 inches by 16 feet. Each line consists of feeding tables, backed-up type leveler, pinch rolls, edge trimmer, and upward cutting shear and gage table. The heavier plates are loaded singly from the pile by vacuum lift, and after being processed, are removed in a similar manner. 100

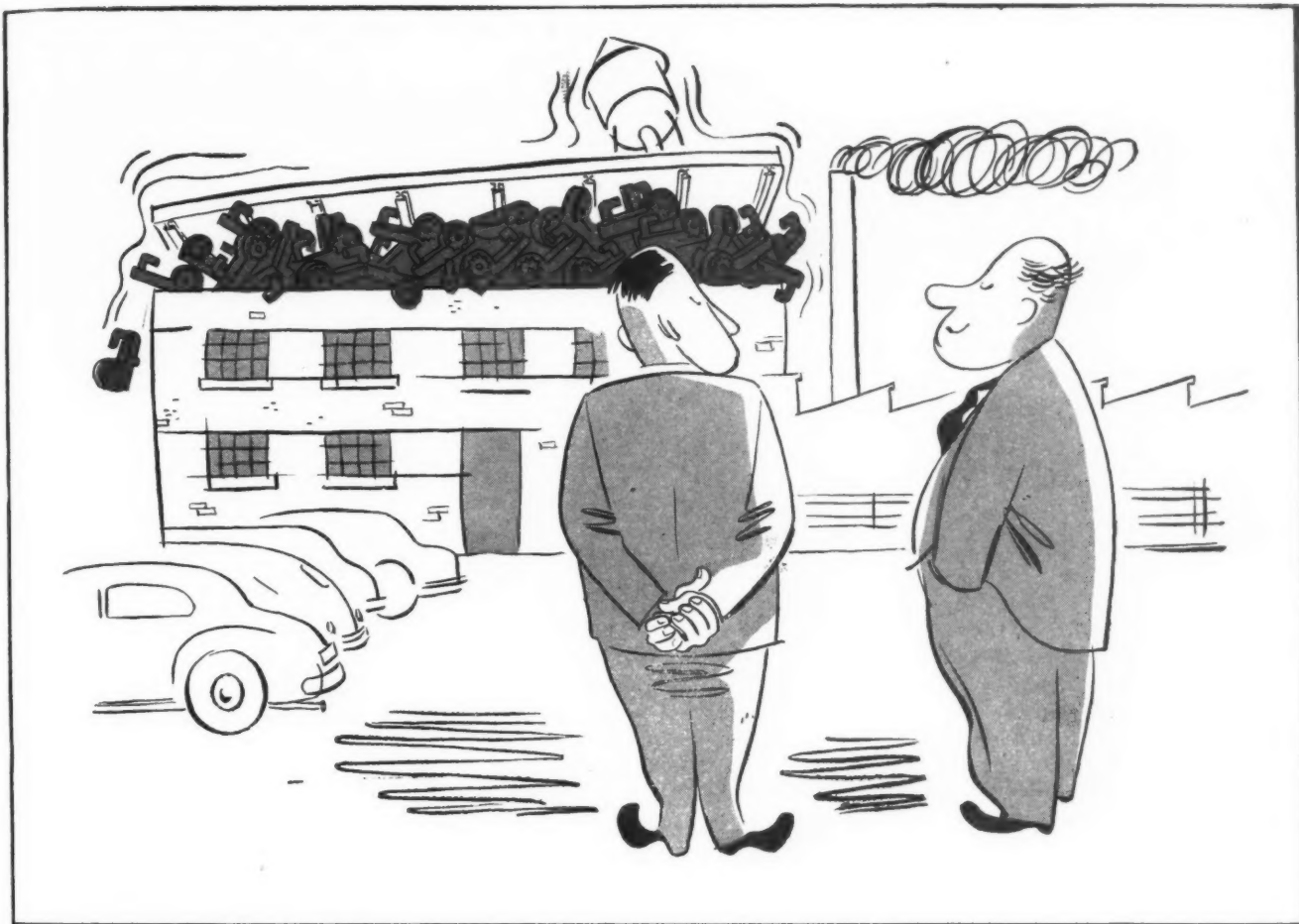


Hufford Hydraulic Press

Two-column hydraulic press made by Hufford Machine Works, Inc., 207 N. Broadway, Redondo Beach, Calif., in capacities from 10 to 200 tons. Adapted for a wide range of operations in metal, plastics, ceramics, and chemical and powder compacting. The standard Model 2-C press is equipped for manual operation, but can be converted to semi-automatic or completely automatic operation.



ation by addition of standard accessories. Either single or multiple ram action is possible for opposed press-



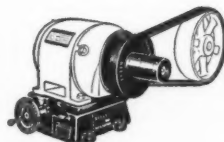
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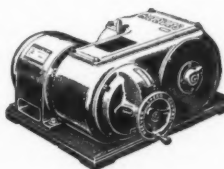
VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.



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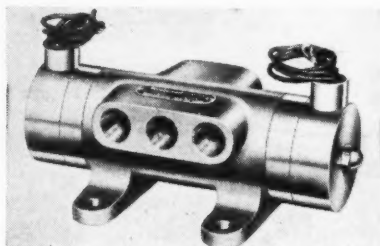
● REEVES-equipped machines turn out more work and do more different jobs—more accurately and economically—because instant, infinitely variable REEVES Speed Control provides the right speed for every operation and every operator, under every changing condition. Specify REEVES Variable Speed Drives for your new machines—apply them to machines now in service. Let an experienced REEVES Speed Control engineer assist you in choosing the proper units for your operation from the complete REEVES line, including a wide range of designs, sizes and speed ratios—with manual, push-button or automatic control. Write for the 114-page catalog, No. M2-450A.

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ing, ejection, and die charging. Automatic timing in any desired sequence of operations is obtained by means of the Hufford "mechanical brain." Hydraulic power units develop ram speeds up to 700 inches per minute and pressures up to 200 tons... 101

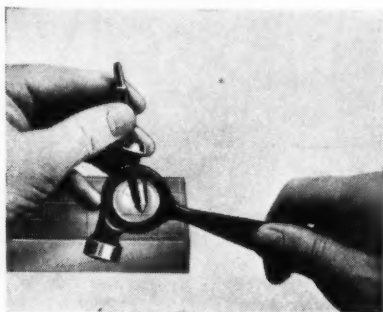


Four-Way Control Valve

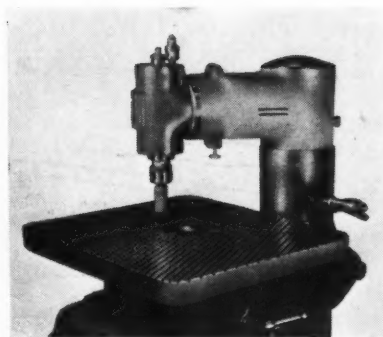
Solenoid-operated four-way control valve developed by Modernair Corporation, 4222 Hollis St., Oakland 8, Calif. This valve is 7 1/4 inches long in the 3/8-inch port model, and 10 3/8 inches long in the 3/4-inch port size. Material in contact with operating fluid is non-corrosive. Operates on line pressure up to 150 pounds per square inch. 102

Diemaker's Hammer with Built-In Magnifier

Accurate spotting and punching of center lines and intersections are simplified by this tool- and die-maker's hammer, introduced by the L. S. Starrett Co., Athol, Mass. A seven-power lens built into the head of the hammer eliminates the usual fumbling and looking away from the work involved when a separate magnifying glass and hammer are used and permits the punch to be precisely



spotted and struck. Made with flat and ball peen heads, and weighs only 4 ounces. 103



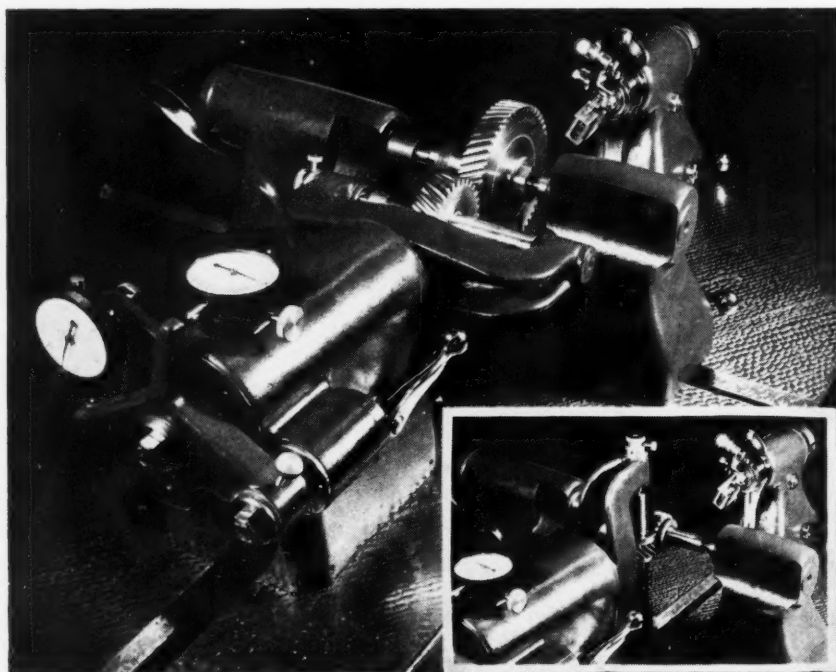
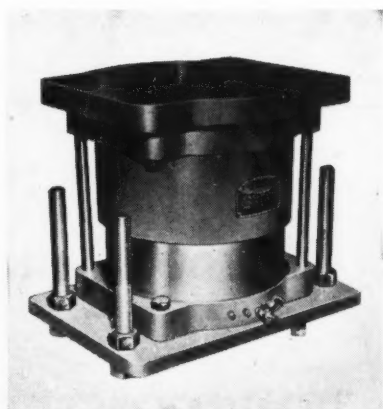
Boyar-Schultz Profile Grinder

Profile grinder with improved method for holding grinding wheels, incorporating specially designed, double-taper collet chuck attached to the top of the spindle. The chuck accommodates collets from 1/8 to 5/8 inch in size, varying by 1/8 inch, and is provided with a convenient method of tightening and loosening the collet. Built by the Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill. 105

Red Ring Gear-Checking Head

A gear-checking head designed to simultaneously or separately check the helix angle, wobble, size, eccentricity, and roughness of the rolling action of a gear by rolling it with a master gear under predetermined pressure. The spindle that carries the master gear-holder can be rotated through an angle of 90 de-

grees for checking either conventional or 90-degree drive gears. The new head can be used on any of the standard Red Ring gear-checkers. The head shown at the extreme right is used for checking index or tooth spacing. Announced by National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. 104



Dayton Rogers Pneumatic Die Cushion

New model die cushion developed by Dayton Rogers Mfg. Co., 2824 Thirteenth Ave., S., Minneapolis 7, Minn., for installation where four suspension rods carry the mounting plate which supports the die-cushion cylinder. This type of installation allows the user to remove the bolster plate without removing the die cushion cylinder. The hardened and ground pin pressure pad is machined to fit the press bed opening, so that all the available bed opening area is utilized. Furnished in ring-holding pressure capacities of 1 1/2 to 75 tons, operated on an air-line pressure of 100 pounds per square inch. Each cushion has combination regulator and gage. 106

Portable Electric Drills and Utility Bench Grinder

One of a line of eight portable electric drills equipped with keyless drill chucks. The line includes models ranging from a 1/4-inch light-weight,

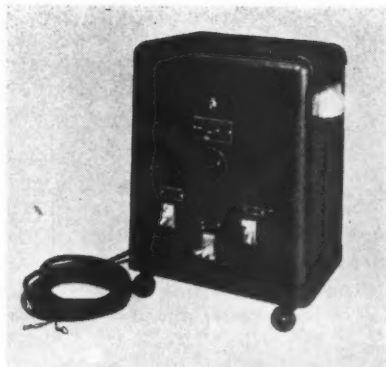


streamline tool to a heavy-duty 7/8-inch unit. Made by the K. O. Lee Co., Aberdeen, S. D. This company has also announced a new precision-built 6-inch utility bench grinder with dynamically balanced, fully enclosed motor of the permanent split-capacitor type. Standard equipment includes fine and coarse grinding wheels, adjustable tool-rests, and an abrasive wheel dresser.107



Quick-Opening Device for Compressed-Gas Cylinders

This "E-Z-Opener" is a simple, inexpensive device manufactured by Nutmeg Industries, 45 Deacon St., Bridgeport 7, Conn., which greatly facilitates the opening of compressed-gas cylinders. It consists of a one-piece casting, which can be readily fitted over the standard cylinder valve handle and securely tightened in place by a knurled set-screw. With the opener in place, the main valve of the tank can be easily turned without using a wrench.108



Hobart High-Frequency Stabilizer and Attachment for Transformer Type Welders

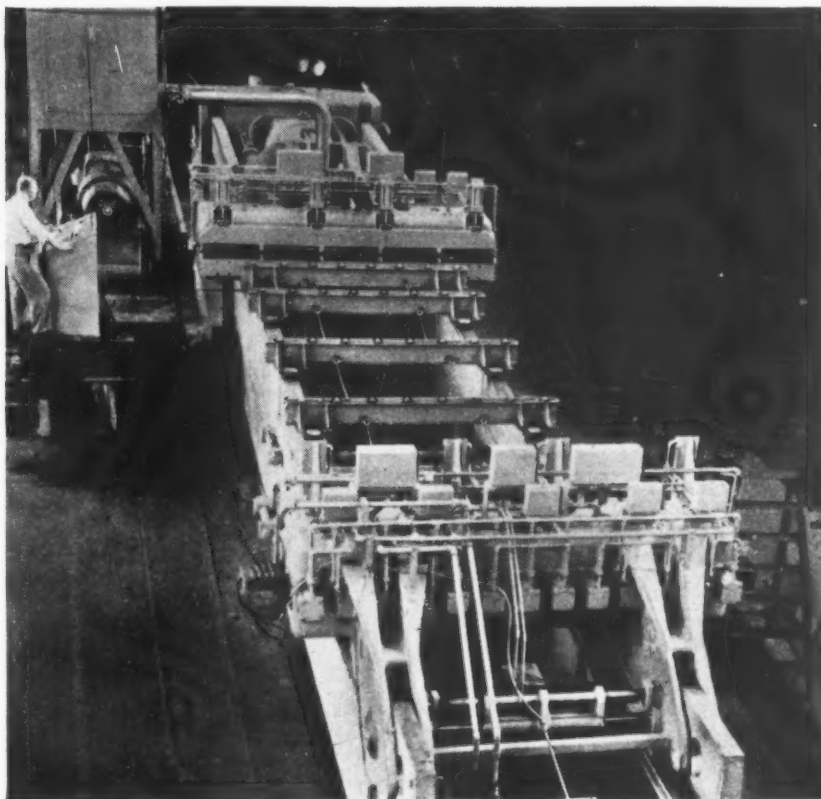
(Left) High-frequency stabilizer designed for use with ordinary alternating- or direct-current welders employed in "Inert-Gas-Shielded" tungsten electrode welding. Made by the Hobart Brothers Co., Hobart Square, Troy, Ohio. (Right) Another Hobart high-frequency stabilizer with

control features designed to simplify inert-gas welding. This unit is designed for use with standard alternating-current transformer type welders. It provides high-frequency stabilization and accurate control over the welding and high-frequency currents. 109

Hydraulic Plate Stretcher-Leveller of Huge Size

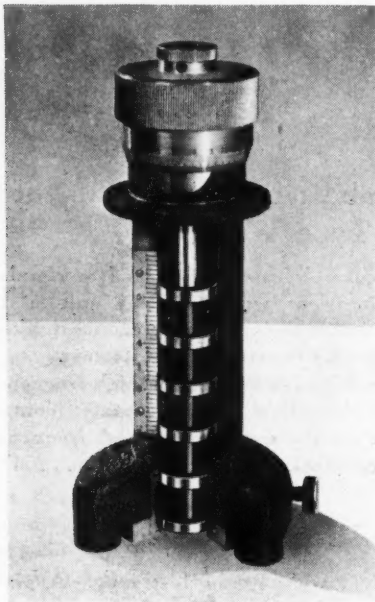
Hydraulic plate stretcher-leveller of special design built by Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y., for installation in a large steel plate mill. This machine, with self-contained oil hydraulic system, has a capacity of 1000 tons. It will handle plates and sheets up to 11

feet wide by 31 feet long. A plate support consisting of five movable carriages facilitates loading and unloading. All movements are performed by remote control from the operating panel. The amount of stretch is shown on an instrument of the dial type.110



“Pla-Chek” Portable Gage

Portable 6-inch Pla-Chek gage designed primarily for checking the smaller classes of work, such as gages, tools, and dies, either on the surface plate or at the machine. This



gage is simple to use, and light in weight. Its capacity can be increased by the addition of 6-inch risers. It is claimed that this gage is accurate to 0.00005 inch. Announced by the Cadillac Gage Co., 20315 Hoover Road, Detroit 5, Mich.111

Raymac Solid-Carbide End-Mills

Double end-mill made of solid carbide; also available in single-end type. Developed for high speed, long



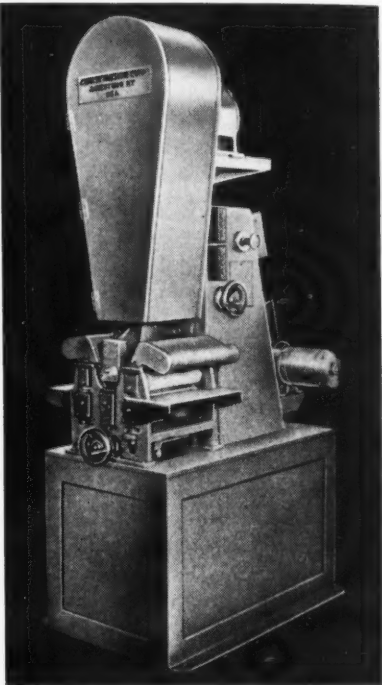
wear, and the rigidity required to insure milling straight slots without taper. This line of end mills is regularly made in sizes from 1/16- to 9/16-inch cutter diameters by Raymac Mfg. Co., Inc., 3729-14 Cass, Detroit 1, Mich.112

Wilton “Powrarm” Floating-Ball Work-Holders and Positioners

Mechanically operated floating-ball work-holder and positioner for light work, known as “Powrarm.” When bolted to a bench, this unit will safely support work weighing up to 70 pounds. A similar unit for supporting work weighing up to 150 pounds is available, which is hydraulically operated by finger-tip control. Both devices can be used to position work



at any desired angle on a 360-degree horizontal or axial plane or on a 180-degree vertical plane. Brought out by Wilton Tool Mfg. Co., 936 Wrightwood Ave., Chicago 14, Ill.113



Curtis “Straight-O-Matic” for Finishing Strip Steel and Flat Metal Parts

“Straight - O - Matic” abrasive - belt automatic unit developed by the Curtis Machine Corporation, Jamestown, N. Y., for finishing flat metal articles and strip steel up to 10 inches wide. This abrasive-belt unit is adapted for finishing flat material or work either before or after fabrication.114

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description — or write directly to the manufacturer, mentioning machine as described in November, 1948, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
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Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]
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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 260 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the November, 1948, Number of MACHINERY

Small Tools

CHICAGO-LATROBE TWIST DRILL WORKS, 411 W. Ontario St., Chicago 10, Ill. Catalogue 225 completely covering the Chicago-Latrobe line of twist drills, reamers, countersinks, counterbores, carbide tools, and special tools; indexed for convenient reference. Copies available if requested on a company letter-head addressed directly to Chicago Latrobe Twist Drill Works.

Electronic Controls

WHEELCO INSTRUMENTS CO., 847 W. Harrison St., Chicago, Ill. Bulletin Z-6500, illustrating and describing the company's line of electronic indicators, controllers, recorders, and combustion safeguards. Copies available if requested on a company letter-head, addressed to Wheelco Instruments Co.

Carbide Gages

LINCOLN PARK INDUSTRIES, INC., 1719 Farris Ave., Lincoln Park 25, Mich. Pamphlet containing case histories showing the savings in inspection costs effected by the use of carbide gages in actual practice. Copies available to those requesting them on a company letter-head.

Temperature Control Equipment

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia 44, Pa. Catalogue ND4A(2), containing 36 pages of data on the latest developments in L & N duration-adjusting electric control for regulating the temperature of electric furnaces, salt pots, and certain fuel-fired furnaces. Also lists Speedomax controllers.1

Small Tools

GEORGE SCHERR CO., INC., 199 Lafayette St., New York 12, N. Y. Catalogue containing 28 pages of data covering the company's line of micrometers, vernier calipers, height gages, optical measuring equipment, and other machinist's and toolmaker's tools. Also listed are books on machine shop work which are now being sold by this company. 2

Metal Stampings

PRESSED METAL INSTITUTE, 829 Union Commerce Bldg., Cleveland 14, Ohio. Pamphlet entitled "Steel Stampings, and Seven-League Boots," emphasizing the importance of metal stampings in the mass production of consumer goods and the achievements possible through cooperation between stamping manufacturers and steel producers. 3

Buffing and Polishing Wheels

AMERICAN BUFF CO., 2414 S. LaSalle St., Chicago, Ill. Catalog containing complete information on the buffing and polishing wheels made by this company, including construction, application, selection at the correct type for various classes of work, a speed chart, and other technical information. 4

Hydraulic Presses

HYDRAULIC PRESS MFG. CO., 1042 Marion Rd., Mount Gilead, Ohio. Bulletin 4804, covering the complete H-P-M line of hydraulic presses, extruding machines, metal die-casting machines, powder-metallurgy presses, briquetting presses, injection molding machines, and compression and transfer molding presses.5

Electronic Pyrometer Controller

BRISTOL CO., Waterbury 91, Conn. Bulletin PB1237, describing the application of a new proportional current-input electronic pyrometer controller applicable to furnaces, electrically heated ovens, plastic molding machines, and similar equipment.6

Precision Investment Casting

ALLIS-CHALMERS MFG. CO., S. 70th St., Milwaukee, Wis. Bulletin 19B6451A, entitled "Precision Investment Casting," illustrating typical parts produced by precision casting, and containing answers to questions on the process concerning application, tolerances, etc. 7

Coolants

F. E. ANDERSON OIL CO., Portland, Conn. Series of case histories giving production and savings resulting from the use of cutting oils and coolants in broaching, drilling, tapping, and grinding operations on a variety of materials. 8

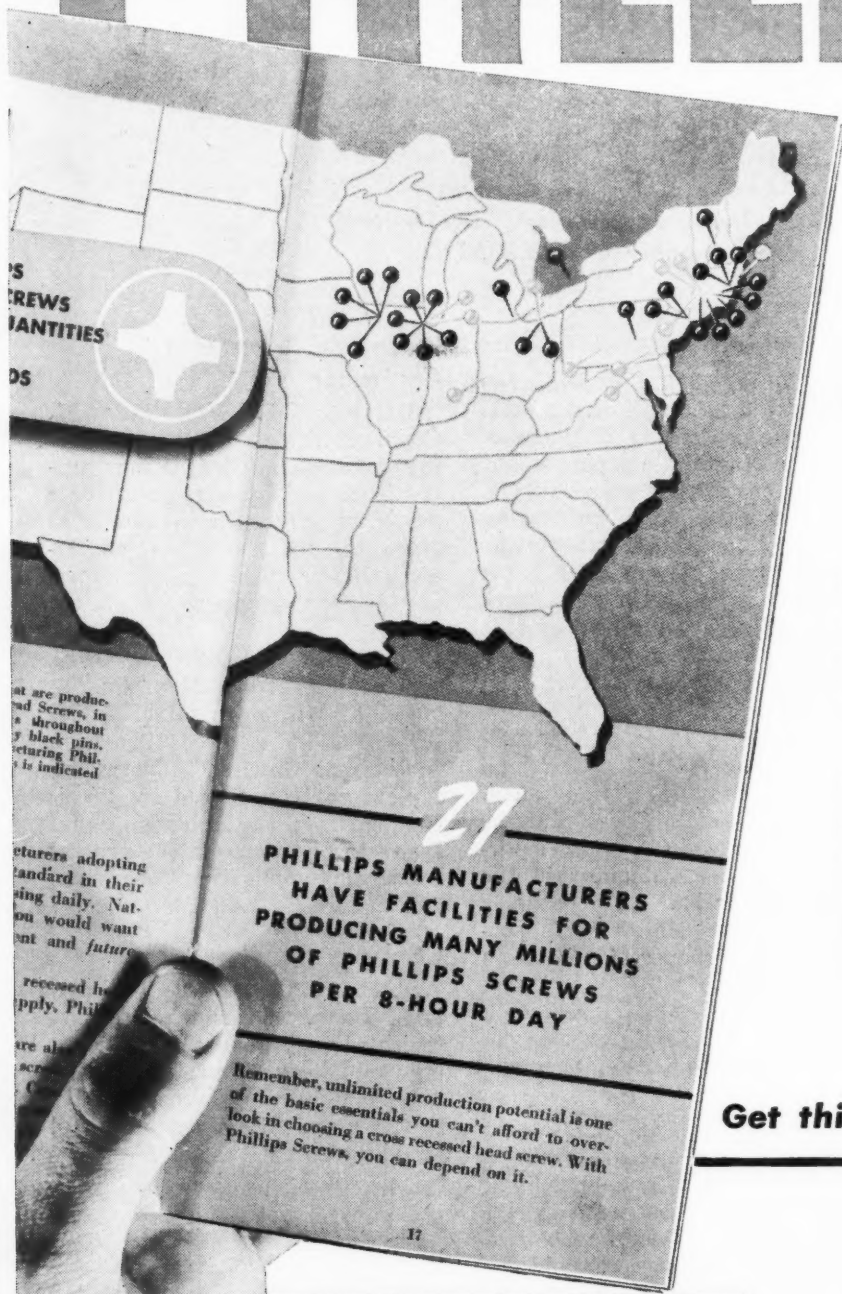
Centralized Lubrication

FARVAL CORPORATION, Cleveland, Ohio. Catalogue entitled "Studies in Centralized Lubrication," describing case histories showing the savings made by the use of Farval centralized lubrication systems.9

Heavy-Duty Gage-Blocks and Fixtures

WEBBER GAGE CO., 12900 Triskett Road, Cleveland 11, Ohio. Folder descriptive of fixtures designed to be used with precision gage-blocks for speeding up tooling. 10

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Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of
American Hdw. Corp.
Elo Tool & Screw Corp.
The H. M. Harper Co.
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Milford Rivet and Machine Co.
National Lock Co.

National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheasant Manufacturing Co.
Reading Screw Co.
Rockford Screw Products Co.
Russell Burdall & Ward
Bolt & Nut Co.
Seovill Manufacturing Co.
Seaboard Screw Corp.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wales-Beech Corp.
Wolverine Bolt Company



Phillips Screw Mfrs.,
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1800 Industrial Trust Bldg.
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Send me the new booklet—"How to Select Recessed Head Screws for Practical Production Driving".

Name _____

Company _____

Address _____

M-35

Die-Less Duplicating

O'NEIL-IRWIN MFG. CO., 332 Eighth Ave., Lake City, Minn. Catalogue 48-14, containing 40 pages of information on the Di-Acro system of die-less duplicating and the engineering service offered by this company.11

Electronic Potentiometer

BROWN INSTRUMENT CO., Wayne and Roberts Ave., Philadelphia 44, Pa. Catalogue 15-13, illustrating and describing the construction and operation of the line of "ElectroniK" potentiometers made by this company.....12

High-Speed Hydraulic Duplicating Equipment

WALKER HYDRAULIC DUPLICATION CO., Box 73, Standish, Mich. Folder describing precision hydraulic duplicating equipment for use on machine tools and special machinery. 13

Industrial Microscopes

BAUSCH & LOMB OPTICAL CO., Rochester 2, N. Y. Catalogue D-15, descriptive of the company's line of stereoscopic wide-field microscopes for use in the industrial, educational, and medical fields.14

Lubricants

E. F. HOUGHTON & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. Circular listing the company's line of lubricants, cutting oils, and greases, together with the uses for which they are especially adapted. 15

Tungsten-Carbide Tools

FIRTH STERLING STEEL & CARBIDE CORPORATION, McKeesport, Pa. Bulletin FE-127, describing the company's line of sintered tungsten-carbide tips and tools, boring bits, "Mechanigript" adjustable tool-holders, and special tips. 16

Metallizing Equipment

METALLIZING ENGINEERING CO., INC., 38-14 Thirtieth St., Long Island City 1, N. Y. Catalogue 401, covering the complete line of metallizing equipment and supplies made by this company.17

Coolant Pumps

ALLIS - CHALMERS MFG. CO., 1009 S. 70th St., Milwaukee, Wis. Bulletin 52B6975, containing data

on Allis-Chalmers foot-mounted, submerged, and side-wall mounted coolant circulating pumps.18

Precision Drill Presses

SOUTH BEND LATHE WORKS, 383 E. Madison St., South Bend 22, Ind. Catalogue 400, illustrating and describing both bench and floor models of the new South Bend 14-inch drill presses.19

Hydraulic Presses

BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa. Bulletin 286, illustrating and describing Southwark hydraulic steam-platen presses designed for use in a variety of industries.20

Nickel Alloys

INTERNATIONAL NICKEL CO., INC., New York 5, N. Y. Revised List A of current publications on nickel-alloy steels, nickel cast irons, nickel brass and bronzes, and nickel-plating.21

Lubricator Valves

TITEFLEX, INC., 519 Frelinghuysen Ave., Newark 5, N. J. Booklet illustrating and describing the Grannan lubricator valve for single-line centralized lubrication systems.22

Crank Shapers

GENERAL ENGINEERING & MFG. CO., Department M, 4417 Oleatha, St. Louis 16, Mo. Catalogue illustrating and completely describing the Gemco line of multi-purpose crank shapers.23

Miniature Ball Bearings

MINIATURE PRECISION BEARINGS, INC., Keene, N. H. Catalogue 49, giving specifications on over forty types and sizes of miniature ball bearings for precision mechanisms.24

Surface-Finish Standards

EDWARD BLAKE CO., 437 Cherry St., West Newton 65, Mass. Bulletin 1048, describing the Baird master set of machine-cut surface-finish standards for surface quality control.25

Permanent-Magnet Separators

ERIEZ MFG. CO., 235 E. Twelfth St., Erie, Pa. Catalogue 12, covering the complete line of Eriez permanent non-electric magnetic separators. 26

Broach-Sharpening Machines

COLONIAL BROACH CO., Box 37, Harper Station, Detroit 13, Mich. Bulletin S-48, describing the complete Colonial line of machines for sharpening flat and round broaches. 27

Meehanite Metal Castings

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Booklet entitled "The Role of Meehanite Metal Castings in Engineering Production." 28

Plate Magnets

ELECTRIC CONTROLLER & MFG. CO., 2700 E. 79th St., Cleveland 4, Ohio. Booklet 903, illustrating various applications of E.C. & M. plate magnets in handling finished steel.29

Gear-Testing Machines

GEORGE SCHERR CO., INC., 199 Lafayette St., New York 12, N. Y. Catalogue descriptive of the new features and advantages of the latest models of Parkson gear-testers. 30

Slide-Rule for Selecting Plastics

DUREZ PLASTICS & CHEMICALS, INC., North Tonawanda, N. Y. Slide-rule for quickly selecting the proper type of Durez for various applications.31

Medium-Duty Lathes

AMERICAN TOOL WORKS CO., Cincinnati 2, Ohio. Bulletin 16-C, illustrating and describing the American 20-inch medium-duty "Pacemaker" lathe.32

Collapsing Taps

GEOMETRIC TOOL CO., New Haven 15, Conn. Bulletin S-4, outlining the new and improved features of Geometric Class S collapsing taps.33

Flexible Insulated Couplings

CHARLES BOND CO., 617 Arch St., Philadelphia, Pa. Catalogue containing data on flexible insulated couplings, of value to engineers, designers, and users.....34

Electric Tachometers

METRON INSTRUMENT CO., 432 Lincoln St., Denver 9, Colo. Bulletin 103, describing the Metron electric hand tachometers and accessories. 35

Bar and Sheet Steel

JOSEPH T. RYERSON & SON, INC., P.O. Box 188, Emeryville, Calif. Booklet illustrating and describing the company's steel service plant recently opened at Emeryville. 36

Dust Collecting Systems

AGET-DETROIT Co., 398 Main at Washington, Ann Arbor, Mich. Bulletin A-550, illustrating and describing a large capacity dust collecting system, known as Model 11B50 Dustkop.37

Flexible Couplings

D. O. JAMES MFG. Co., 1140 W. Monroe St., Chicago, Ill. Catalogue 48, containing descriptions and specifications covering the complete James line of flexible couplings. 38

Stainless-Steel Drafting Machines

EMMERT MFG. Co., Waynesboro 2, Pa. Bulletin 6-48, announcing new stainless-steel drafting machines and counterbalanced drawing-boards. 39

Spot-Welders

WAITCUS MFG. Co., 638-42 S. Clark St., Chicago 5, Ill. Pamphlet and price list covering the line of portable production spot-welding machines manufactured by this company.40

Alloy Castings

MICHIANA PRODUCTS CORPORATION, Michigan City, Ind. Booklet 111, listing compositions, properties, and applications of various heat-resistant alloys.41

Mechanical Equipment

ACME EQUIPMENT Co., INC., Chicago 6, Ill. Circular announcing Government surplus equipment, including machine tools, trucks, and other machines.42

Ebonol Blackening Process

ENTHONE, INC., 442 Elm St., New Haven 2, Conn. Catalogue descriptive of the Ebonol processes for coloring and blackening metals.43

Research

SOUTHWEST RESEARCH INSTITUTE, Box 2296, San Antonio, Texas. Booklet outlining research services and facilities available to industry in the Southwest.44

Research

STANFORD RESEARCH INSTITUTE, Stanford, Calif. Booklet outlining the facilities in research and development offered to industry by the Institute.45

Aluminum-Alloy Motors

KING-WYSE, INC., Archbold, Ohio. Circular descriptive of King-Wyse aluminum-alloy electric motors. 46

Motorized Speed Reducers

FALK CORPORATION, Milwaukee 8, Wis. Circular announcing the new Falk all-steel Motor-reducer. 47

Rust-Preventive Compound

RUST-OLEUM CORPORATION, Evanston, Ill. Descriptive catalogue entitled "Rust-Oleum Stops and Prevents Rust." 48

Information on Selling to the Navy

The Navy Department, Washington, D. C., announces the publication of the third edition of a booklet entitled "Selling To The Navy." This publication was prepared primarily to assist the smaller business concerns of the United States in obtaining Navy contracts, but the information should be of value to all those who wish to participate in selling to the Navy.

The various steps involved, from the time the contract is received to the final payment, are outlined. A list of the Navy Purchasing Activities throughout the country and a directory of the field inspectors of Navy material are included. Copies are available from the Navy Department or from bureau contracting officers or officers in charge of field purchasing.

* * *

Sinclair Refining Co. Opens Modern Research and Development Laboratories

Laboratories designed to explore all phases of petroleum development from the production of oil from oil-shale and coal to the improvement of lubricants, fuels, and other products in daily use, have been opened by the Sinclair Refining Co. at Harvey, Ill. These research and development laboratories comprise nine buildings which have 215,000 square feet of floor space. They accommodate over 400 scientific and administrative employes.

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (November, 1948) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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By E.S.S.

BETWEEN GRINDS

The Old Ox-Road

One of the younger staff editors was found chuckling recently while consulting our editorial files. The card he held was that of a streamline automobile manufacturer of today with a notation of their products "wagons, autos, and harnesses." We maintained silence.

The Engine and I

"The Garden of Eden saw the first engine—a complex arrangement of several hundred small motors, working together to form one intricate, but efficient, motor system. The machines for transmission and application of the power were in the same frame with the engine. An elaborate system of levers, it had an efficiency of 40 per cent. This earliest of all power units is still in wide use, its design somewhat refined by the years, its average wear-life increased. But its basic capacity remains unchanged. The latest model is sitting in *your* chair, holding this magazine." Quoted from an article "From Adam to Atom" describing the progress of pow-

er, in the house organ "Production Road" of the Twin Disc Clutch Co.

Canning Season for Birds

Much as the housewife puts chicken up in cans so that she may run to her pantry shelf when unexpected visitors drop in, the Navy is canning airplanes. Two planes to a giant-size can with a dehumidifying agent sealed in as a preservative—and the bones left in.

Solution to Rail Track Problem

Last month we left you suspended with a problem about a mile-long rail track that expanded one foot in hot weather, all in the middle. How high did it buckle? Answer is 50.38 feet high. Surprised? We were, too. Now follow us closely, but don't breathe down our neck. Since the track expands at the middle point, one divides a mile in half, which is 2640 feet, if one knows a thing or two. Because it expands one foot, the expanded half becomes 2640.5. Then one gets out the old hypotenuse the-

orem, all about the square of the hypotenuse equalling the squares of the sides of a right-angle triangle, so: $x^2 + 2640^2 = 2640.5^2$. Or, $x^2 + 6,969,600 = 6,972,240$. Or, $x^2 = 2640$. Or, $x = 50.38$. Or, did we lose you on the way?

Transitory No. 132

From a correspondent: "Recently I was given a copy of one of your Reference Books, No. 132, and it is my desire to own some more of these. Is it still possible to purchase them or am I thirty years too late?" Yes, my good man, you are too late. No. 132, published in 1914, was near the end of the series of 141 Reference Books which were out of print by 1925. Since they exited individually, your guess of thirty years is as good as any.

Anglo-Seltzer

The code for cables relayed to British Information Services, located in Rockefeller Plaza, New York City, is "Digestion, New York." The next applicant for a code name will probably get "Indigestion."

Industrious Yankee—Rhode Islander by birth, HAROLD E. MURPHEY has spent his gainfully employed (this cliché may soon be abandoned and is used here somewhat nostalgically) life, which began at thirteen years of age, in and out of New England machine-building companies. At eighteen, he joined C. B. Cottrell & Sons, Westerly, R. I., to learn the machinist trade. After seven years, the principle of rotation was applied, and Mr. Murphey spent a year drafting in a shop at Hope Valley and the next fifteen years with four well-known



firms. Then he returned to Cottrell as chief tool and special machine designer, thus reaping the crop. After a decade or so of this, he moved south, a stone's throw to Stonington, Conn., where he was jig and fixture designer for the Atwood Machine Co. until his retirement in 1946. Then Mr. Murphey winged back to his birthplace, where he now turns the soil as a hobby and continues to "keep his hand in" by sending us articles as he has done since 1910, the latest of which you may read on page 219 of this issue.

News of the Industry

Illinois and Indiana

NATIONAL CYLINDER GAS Co., manufacturer of industrial gases, oxy-acetylene welding apparatus, arc-welding equipment, and electrodes, announces that the executive headquarters of the company have been moved to 850 N. Michigan Ave., Chicago, Ill. The Chicago district sales office remains at 4700 West 19th Street.

ELGIN NATIONAL WATCH Co. announces that the Sapphire Products Division of the company in Aurora, Ill., will be known hereafter as the INDUSTRIAL PRODUCTS DIVISION. This change has been made because of the fact that other products besides the sapphire products are now being made by this division, including diamond finishing compound.

F. W. ANDERSON, 800 N. Clark St., Chicago, Ill., has been appointed sales representative in the Illinois and Wisconsin territory for the "Sand-O-Flex" sanding wheels and abrasive cartridges made by MERIT PRODUCTS, INC., Los Angeles, Calif.

HARRY CONN has recently been made chief engineer, in charge of the Engineering Division, of Scully-Jones & Co., Chicago, Ill., manufacturer of standard and special production tools. He was previously head of the La Salle Engineering Co., of New York.

THOMAS L. JENNER has been transferred from the main office to the Chicago office of Pratt & Whitney Division, Niles-Bement-Pond Co., West

Hartford, Conn. His new duties will be associated with machine tool sales.

WILLIAM F. COLEMAN has been elected vice-president of sales for Amgears, Inc., Chicago, Ill. Mr. Coleman joined the company after more than twenty-five years' executive experience in the gear industry.

L. G. S. SPRING CLUTCH CORPORATION, DIVISION OF CURTISS-WRIGHT CORPORATION, Indianapolis, Ind., announces the establishment of the following new sales offices: SMITH POWER TRANSMISSION Co., 1545 E. 23rd St., Cleveland 14, Ohio; TRANSMISSION ENGINEERING Co., INC., 244 N. 22nd St., Philadelphia 3, Pa.; and POTTER & DUGAN, INC., 29 Wileson St., Buffalo 2, N. Y.

Michigan

MIDWEST CHROME PROCESS Co., 83 E. Milwaukee Ave., Detroit 2, Mich., announces a new chromium-plating service by means of which small parts, such as screws, rivets, screw machine parts, stampings, etc., are handled in bulk (without the use of racks), thus reducing the cost of the process.

JAMES K. FULKS, vice-president in charge of manufacturing of the Ex-Cell-O Corporation, Detroit, Mich., has been made a director of the company. JOHN F. MILLER has been appointed sales manager of the Machine Tool and Cutting Tool Divisions, and D. H. McIVER sales manager of the Aircraft and Miscellaneous Parts Divisions.



William F. B. Henderson, New Executive Vice-president of the E. W. Bliss Co.

WILLIAM F. B. HENDERSON has been appointed executive vice-president of the E. W. Bliss Co., Detroit, Mich., manufacturer of hydraulic presses, can machinery, and rolling mills. He has also been elected to the board of directors. For the last four years, Mr. Henderson has been executive vice-president and a director of the Clearing Machine Corporation, Chicago, Ill.

WALKER HYDRAULIC DUPLICATOR Co., Standish, Mich., has recently been organized by C. E. Walker, designer



(Left to Right) James K. Fulks, Newly Elected Director of Ex-Cell-O Corporation; John F. Miller, Sales Manager of Machine Tool and Cutting Tool Divisions; and D. H. McIver, Sales Manager of Aircraft and Miscellaneous Parts Divisions

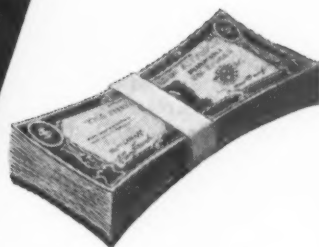
"CHEAP" TOOLS *shackle* INDUSTRY AND TRADE



Use of "cheap" metal-cutting tools proves the adage of "Penny Wise, Pound Foolish". Their performance is unreliable and inconsistent.

Sound, durable cutting tools are worth the price. A few pennies additional first cost will save dollars of ultimate cost—in grinding, tool inventory, set-up time, and idle machine time, with the result that production is reliable and sustained.

Innumerable performance records continue to demonstrate the superior worth of Kennametal tools in their ability to reduce over-all costs for tooling and production—and do this consistently. Kennametal has an extra measure of value. Exclusive processing, scientifically controlled, assures maintenance of a sound physical structure having trustworthy properties of high hardness and great strength.



Use of cheap money tools has likewise proved to be "Penny Wise, Pound Foolish". Their purchasing value is uncertain and erratic.



BILL H. R. 5031 introduced into the House of Representatives, January 20, 1948, by Congressman Buffet of Nebraska cited as the "Gold Standard Act of 1948."

A BILL

"To restore the right of American citizens to freely own gold and gold coins; to return control over the public purse to the people; to restrain further deterioration of our currency; to enable holders of paper money to redeem it in gold coin on demand; to establish and maintain a domestic gold coin standard; and for other purposes."

Sound money is a trustworthy tool of measurement that serves to evaluate accurately the relative worth of goods and services in all sorts of exchange activities. With a stabilized currency an individual knows assuredly the worth of his earnings and reserves—savings, insurance, pensions. A businessman is able to make firm, fair contracts, meet current and future obligations with certainty, and engage safely in creative ventures.

Innumerable historic examples have proved that the convertible Gold Standard is the most useful money system ever devised. Managed currency, initiated 15 years ago in the United States, has impaired our money tool and made it untrustworthy. A return to the historic honest dollar, as proposed in a bill now before Congress*, will have a stabilizing effect on our economic life.

While you are waiting for the return of 100 cent dollars, Kennametal tools, of premium value, are waiting for you. They are one technological development that can help mitigate the ill effects of inflation.



and builder of a hydraulic duplicating attachment for machine tools. Mr. Walker was formerly associated with the Turchan Follower Machine Co. of Detroit as part owner and vice-president in charge of sales and product development. During the war years, he was responsible for many innovations in tracer-controlled hydraulic duplicating equipment. The new company will engage in the manufacture of precision hydraulic duplicating equipment for high-speed production use on all types of boring mills, milling machines, planers, lathes, and grinders, as well as special machinery.

HANCHETT MAGNA-LOCK CORPORATION, Big Rapids, Mich., has recently been organized to continue the manufacture of the line of magnetic chucks formerly produced by the HANCHETT MFG. CO., of Big Rapids. The officers of the new company are J. F. MANTING, president; D. D. STONE, vice-president and treasurer; and R. V. HANCHETT, secretary. Attention is called to the fact that the new organization is entirely separate from the old Hanchett Mfg. Co.

A. A. VETTER has been appointed consulting sales engineer for the Buhr Machine Tool Co., Ann Arbor, Mich. He will be available to the industry for consultation on drilling, tapping, and retooling problems.

PAUL T. PETERSON has been appointed chief engineer of the Dalzen Tool & Mfg. Co., Detroit 5, Mich. He has served in a similar capacity with the Apex Broach Co. and the Colonial Broach Co. of Detroit.

ROY S. RANKIN has resigned as vice-president and director of sales of Harris Calorific Sales Inc., Detroit, Mich., to become manager of the Progressive Welder Sales Co. of Detroit.

Missouri and Texas

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces that a new direct sales office for the Cimcool Cutting Fluid Division of the company has been opened at 4053 Lindell Blvd., St. Louis 8, Mo. **M. R. SKIRVIN** will be in charge of the new office.

HYDRO-LINE MFG. CO., Rockford, Ill., announces that it has appointed **ROGERS & BAXTER**, 2013 Olive Street, St. Louis, Mo., representative for the Hydro-Line air and hydraulic cylinders and special machinery.

FOXBOBO CO., Foxboro, Mass., manufacturer of industrial instruments, control valves, and similar equipment, recently moved the Houston branch of the company from the Sterling Building to its new building at 2518 South Blvd., Houston 6, Tex.



J. C. Kuhn, Newly Appointed General Sales Manager of the Morse Twist Drill & Machine Co.

New England

J. C. KUHN has been appointed general sales manager of the Morse Twist Drill & Machine Co., New Bedford, Mass., succeeding **MORT RAINERY**, who has resigned as vice-president and sales manager. Mr. Kuhn was previously eastern district sales manager of the Blackhawk Mfg. Co., Milwaukee, Wis.

REG. ANDERSON has been appointed sales engineer in New York State and New England for the Threadwell Tap & Die Co., Greenfield, Mass. He has been connected with the company for sixteen years, serving as chief inspector for several years.

A. L. CARR was recently appointed sales manager for the Morse Twist Drill & Machine Co., New Bedford, Mass. Mr. Carr, who has been with the Morse organization for thirty-two years, was formerly assistant sales manager.

PENN MFG. CO., Hartford, Conn., announces that it has recently acquired the main line of machines manufactured by the **STANDARD MACHINERY CO.**, Providence, R. I., consisting of metal-rolling mills, punch presses, swaging machines, Turk heads, and special large-diameter bearings. Operations will continue temporarily at the Providence plant, but it is planned eventually to move the newly acquired line to the Hartford and New Britain plants of the company.

CLAROSTAT MFG. CO., INC., manufacturer of resistors, controls, and resistance devices, has moved from 130 Clinton St., Brooklyn, N. Y., to Dover, N. H.

New York and New Jersey

CARBORUNDUM CO., Niagara Falls, N. Y., announces the following changes in personnel: **E. B. FORSE**, manager of the Refractories Division at Perth Amboy, N. J., has been made assistant vice-president; **C. E. HAWKE**, director of sales, will succeed Mr. Forse as manager of the Refractories Division. **E. R. BAXTER** will become director of sales, and **G. R. RAYNER, JR.**, assistant director of sales administration.

ACME PATTERN & MACHINE CO., INC., Buffalo, N. Y., announces the following appointments: **ROBERT E. COLEMAN** has been named vice-president in charge of sales and **WILLIAM A. CARLSON** vice-president in charge of manufacturing; **HENRY M. WILLIAMS** has been appointed chief engineer of the Fabricating Equipment Division; and **NELSON M. HOPKINS** has been made assistant to the president.

DAWSON J. BURNS, who recently resigned as president of the Ward Leonard Electric Co., Mount Vernon, N. Y., was elected chairman of the executive committee. **ARTHUR A. BERARD**, executive vice-president and general manager of the company, was elected president to succeed Mr. Burns; he will also continue to hold the position of general manager.

LEWIS P. NAYLOR has been appointed sales manager of the Ozalid Division of the General Aniline & Film Corporation, Johnson City, N. Y., manufacturer of reproducing machines and sensitized papers. Before joining the Ozalid Division Mr. Naylor had been eastern sales manager of the Victor Adding Machine Co.

FORREST E. ALLEN, formerly a member of the faculty of Iowa State College in the Department of Mechanical Engineering, and associate professor in charge of the instruction on metallurgy, has joined the Development and Research Division of The International Nickel Co., Inc., 67 Wall St., New York City.

JACK A. AHERN, for twenty-five years connected with the firm of Kirke R. Wilson, Buffalo, N. Y., has assumed the management of the company, following the recent death of the founder, Kirke R. Wilson. **FRANK WILSON**, brother of the founder, will continue to superintend plant operations at Arcade, N. Y.

CROCKER-WHEELER ELECTRIC MFG. CO., DIVISION OF THE **JOSHUA HENDEY CORPORATION**, Ampere, N. J., has reopened its Buffalo branch office in the Ellicott Square Bldg., Buffalo, N. Y. The new branch is headed by **LOUIS E. RAU**.

JOHN A. STORRS has been appointed sales representative in the New

This New Ozalith Paper Costs Little—Has Great Mechanical Strength—Washable, Plastic Surface!

MACHINERY, November, 1948—267

York district for Kennametal, Inc., Latrobe, Pa. He will make his headquarters at the Kennametal office at 6 West Broadway, New York City.

AIRCO EXPORT CORPORATION, 33 W. 42nd St., New York 17, N. Y., announces that the name of the firm has been changed to AIRCO CORPORATION (INTERNATIONAL). There is no change in the company or personnel.

ROBERT M. HONEGGER, general manager of the Buffalo plant of the Farrel-Birmingham Co., Inc., Ansonia, Conn., was recently elected a member of the board of directors.

J. F. GINNA has been made assistant to the vice-president in charge of production of the American Car & Foundry Co., 30 Church St., New York City.

V. PAUL YALE has been made district representative, in charge of the states of Michigan and Indiana, for the Walker-Turner Division of the Kearney & Trecker Corporation, Plainfield, N. J.

S. R. ZIMMERMAN, JR., has been named director of friction-material research and development for Raybestos-Manhattan Inc., Passaic, N. J.

Ohio

H. L. TIGGES, executive vice-president of Baker Brothers, Inc., Toledo, Ohio, and a director of the National Machine Tool Builders' Association, has been engaged as an expert to direct the mobilization planning activities of the Machine Tool Section of the National Security Resources



H. L. Tigges, Who has Recently been Appointed in Charge of the Mobilization Planning Activities, Machine Tool Section, of the National Security Resources Board

Board. Mr. Tigges, whose services have been lent by Baker Brothers to the Board, will have charge of continuing contacts with the machine tool manufacturers with whom standby schedules of production were recently placed for the possible initial manufacture of 100,000 machine tools in case of an emergency.

VARIETY MACHINE & STAMPING CO., 12695 Elmwood Ave., Cleveland, Ohio, has been purchased by WALLACE F. ARDUSSI. The company has been manufacturing metal stampings, assemblies, tools, and dies for the last twenty-seven years. Mr. Arducci was previously chief engineer for the Machinery Division of the Industrial Rayon Corporation, and had also been vice-president of the Hupp Corporation, in charge of sales and engineering development at the Globe Machine and Stamping Division. He resigned the latter position in February, 1948.

M. P. WINTER was appointed vice-president and director of engineering of the Eaton Mfg. Co., 739 E. 140th St., Cleveland, Ohio, at a recent meeting of the board of directors. Mr. Winter has been associated with the company since March, 1946, when it acquired the Dynamic Corporation, Kenosha, Wis., of which Mr. Winter was president and general manager.

ERICKSON TOOLS DIVISION OF THE ERICKSON STEEL CO., 2309 Hamilton Ave., Cleveland 14, Ohio, announces that it has taken over the manufacture of State combination boring and reaming tools, formerly made by the EAST SHORE MACHINE PRODUCTS CO., of Cleveland.

MOTCH & MERRYWEATHER MACHINERY CO., Cleveland, Ohio, has been named exclusive selling representative in the continental United States for the line of external honing equipment made by DELAPENA & SON, LTD., of Cheltenham, England.

KENNETH G. DONALD was elected president of Jack & Heintz Precision Industries, Inc., Cleveland, Ohio, at a recent meeting of the board of directors. He succeeds BYRON C. FOY, who resigned as president and chairman of the board.

CLEVELAND TAPPING MACHINE CO., Cleveland, Ohio, has appointed the W. A. McLAREN EXPORT CORPORATION, LTD., 302 Crown Bldg., 615 W. Pender St., Vancouver, B. C., Canada, sales representative for the company in western Canada.

GREER HYDRAULICS, INC., announces the opening of a new branch office in Dayton, Ohio, located in the Keith Bldg. on 4th St., corner of Ludlow St. SUMNER BARTON will head the new office.

TOM J. SMITH, JR., has retired as president of the Pressed Metal Institute, Cleveland, Ohio. Vice-president WALTER A. GORRELL will direct the activities of the Institute temporarily.

BUCKEYE TOOLS CORPORATION, Dayton, Ohio, has appointed JOHN BEST & ASSOCIATES, of Toronto, as distributor in Canada for Buckeye portable air and electric tools.

CARL J. LAMB has been appointed consulting engineer for the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

G. O. ROMIG has been appointed sales manager of the Cleveland, Ohio, plant of the Claud S. Gordon Co.

Pennsylvania

KENAMETAL, INC., Latrobe, Pa., announces an expansion program which will involve an expenditure of over \$200,000. The program includes the erection of a new plant building and an addition to the laboratory. The new plant building will provide 6000 square feet of additional floor space, and the laboratory extension will increase the floor space 1600 square feet. Both of these structures are expected to be ready for occupancy early in December.

ERIE FOUNDRY CO., Erie, Pa., announces that D. A. CURRIE was re-elected president and treasurer at the annual meeting of stockholders and directors. Other appointments made were: F. F. CLARK, honorary vice-president; JAMES A. CURRIE, first vice-president; ROBERT N. YATES, second vice-president; and C. D. PINNEY, secretary.

MARCUS A. MARKLEY has been appointed manager of the Industrial Products Department of the Sun Oil Co., Philadelphia, Pa., succeeding RAY H. ANDERS, who has been assigned to special work in the Administrative Department.

SAMUEL M. GAHAGEN, formerly with the Rustless Iron & Steel Corporation, of Baltimore, Md., has joined the Jessop Steel Co., Washington, Pa., in the capacity of chief metallurgist.

Wisconsin

JOHN H. BATTEN has been elected president of the Twin Disc Clutch Co., Milwaukee, Wis., following the resignation of P. H. BATTEN, founder of the company, who previously held the positions of president and chairman of the board. Mr. P. H. Batten will continue to serve as chairman. The new president joined the com-



MACHINERY'S DATA SHEETS 621 and 622

SPECIFICATIONS FOR HIGH TENSILE-STRENGTH MUSIC SPRING WIRE—1

These specifications and those in Data Sheet No. 622 are for Associated Spring Corporation Standard AS5 high tensile-strength music spring wire, produced according to approved practice of the open-hearth or electric-furnace process. They cover the best grade of music wire used by the divisions of the Associated Spring Corporation. This spring material complies with government, automotive, and such national society standards as A.S.T.M. or S.A.E.

Chemical Analysis—The chemical analysis will vary with the wire size, but in any one size a carbon range of not more than 0.10 per cent is desirable. The maximum chemical range for wires covered by this specification will be:

Carbon.....	0.70 to 1.00 per cent
Phosphorus.....	0.030 per cent, maximum
Manganese.....	0.25 to 0.60 per cent
Silicon.....	0.15 to 0.30 per cent
Sulphur.....	0.030 per cent, maximum

Physical Properties—The wire must be flat and must not be twisted in drawing. To test, cut six coils of wire off bundle an let fall on the floor. The wire must lie flat and not spring up and show a wavy condition. To test wire for uniform physical properties, wind 10 or 12 feet on an arbor according to the following table:

Wire Size, Inch	Arbor Diameter, Inch
0.034 down to 0.005	0.102
0.035 to 0.045	0.145
0.046 to 0.055	0.212
0.056 or over	0.250

After winding the wire, the coil should be stretched out three or four times its original length. Under this test the coils must all stretch at a uniform rate and show no splits or fractures of the wire.

The wire must not be overdrawn or cuppy and must wind on its own diameter. The tensile strength of the wire must be in accordance with the values given in Data Sheet No. 622.

Permissible Variations in Dimensions—The diameter of the wire must not vary from that specified by more than the amounts given in the following table:

Wire Diameter, Inch	Permissible Variations, Inch
0.026 and under	Plus or Minus 0.0003
0.027 to 0.063	Plus or Minus 0.0005
0.064 and over	Plus or Minus 0.001

The wire must not be out-of-round by more than one-half the total permissible size tolerance.

Finish—Unless otherwise specified by purchaser, music spring wire should have a bright lustrous finish.

Surface Condition—The surface should be smooth and free from defects such as seams, pits, die marks, and other imperfections tending to impair the use of the wire for springs.

After heating samples of wire to 750 degrees F. and etching, the surface of the wire should be examined. The wire should be etched in a solution of equal parts of chemically pure hydrochloric acid and water at a temperature of 165 to 175 degrees F. for a sufficient length of time to remove approximately 1 per cent of the diameter of the wire.

MACHINERY'S Data Sheet No. 621, November, 1948

Compiled by Associated Spring Corporation

SPECIFICATIONS FOR HIGH TENSILE-STRENGTH MUSIC SPRING WIRE—2*

Wire Diameter, Inch	Tensile Strength, Pounds per Square Inch		Wire Diameter, Inch	Tensile Strength, Pounds per Square Inch	
	Minimum	Maximum		Minimum	Maximum
0.004	439,000	485,000	0.048	316,000	339,000
0.005	426,000	471,000	0.051	313,000	335,000
0.006	415,000	459,000	0.055	310,000	331,000
0.007	407,000	449,000	0.059	306,000	327,000
0.008	399,000	441,000	0.063	303,000	324,000
0.009	393,000	434,000	0.067	300,000	321,000
0.010	387,000	428,000	0.072	297,000	317,000
0.012	377,000	417,000	0.076	294,000	314,000
0.014	374,000	408,000	0.080	292,000	312,000
0.016	367,000	400,000	0.090	286,000	305,000
0.018	361,000	393,000	0.100	281,000	300,000
0.020	358,000	387,000	0.110	277,000	295,000
0.022	355,000	382,000	0.112	276,000	294,000
0.024	351,000	377,000	0.125	271,000	288,000
0.026	347,000	373,000	0.130	269,000	286,000
0.028	343,000	368,000	0.135	268,000	285,000
0.030	340,000	365,000	0.150	263,000	279,000
0.032	337,000	361,000	0.160	260,000	276,000
0.034	334,000	358,000	0.162	259,000	275,000
0.036	331,000	355,000	0.180	254,000	270,000
0.038	328,000	352,000	0.200	250,000	265,000
0.040	325,000	349,000	0.225	244,000	259,000
0.042	323,000	346,000	0.250	240,000	254,000
0.045	319,000	342,000			

Intermediate values may be interpolated.

*Associated Spring Corporation Material Standard AS5.

MACHINERY'S Data Sheet No. 622, November, 1948

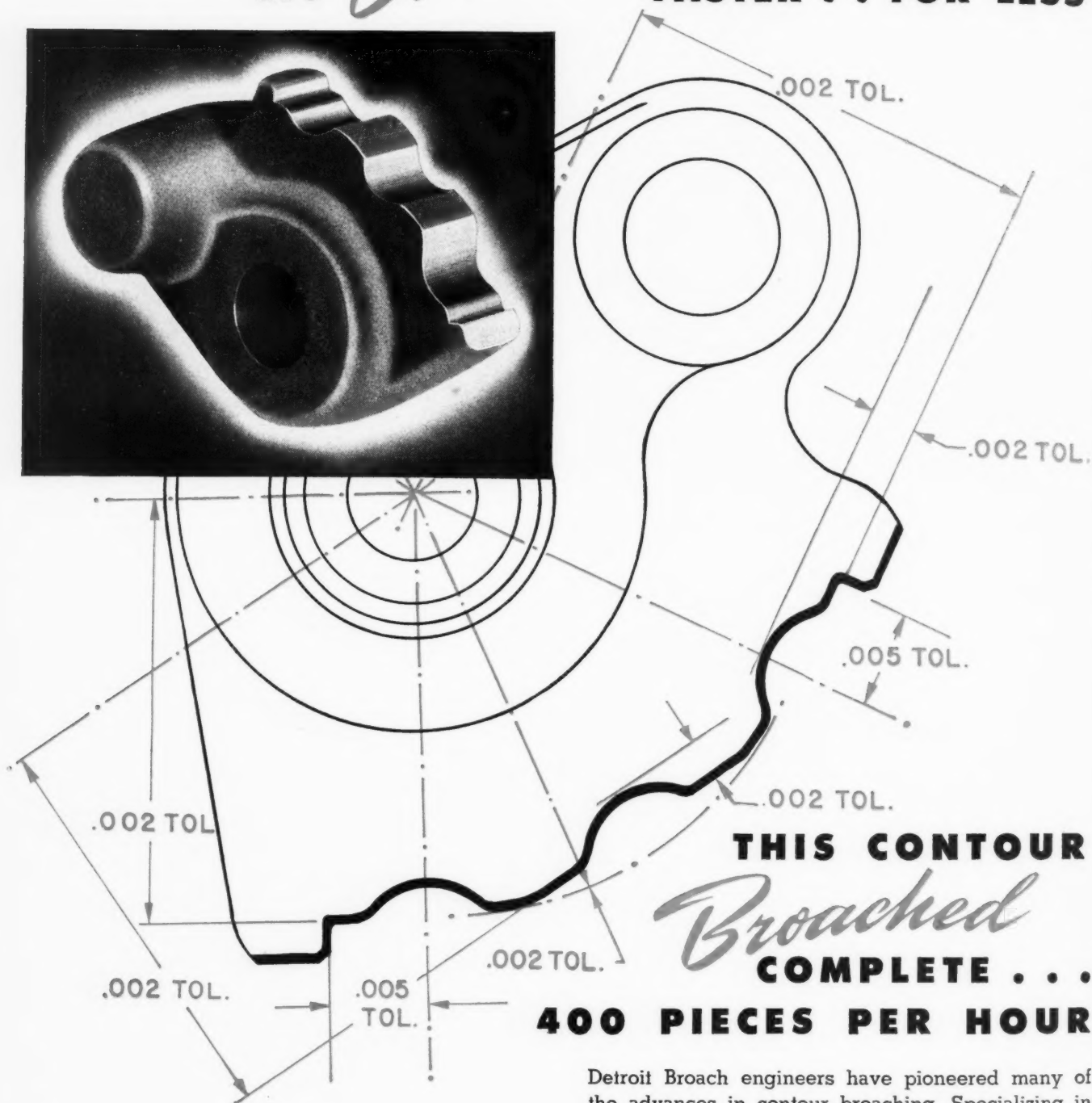
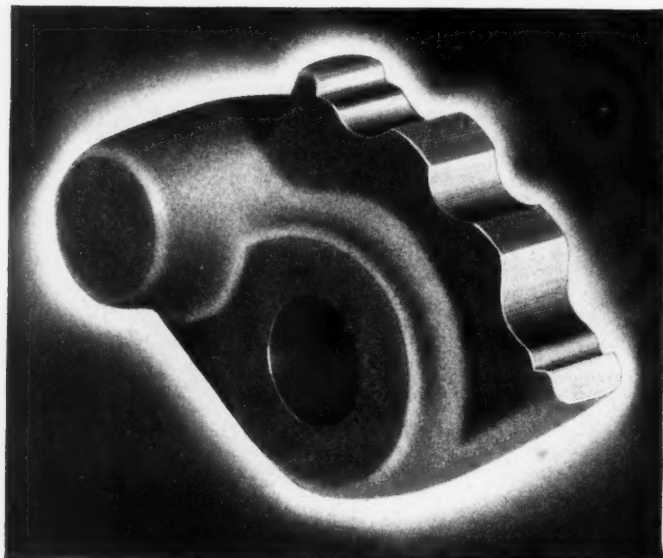
Compiled by Associated Spring Corporation

CONTOURS

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FASTER . . FOR LESS



THIS CONTOUR

Broached

COMPLETE . . .

400 PIECES PER HOUR

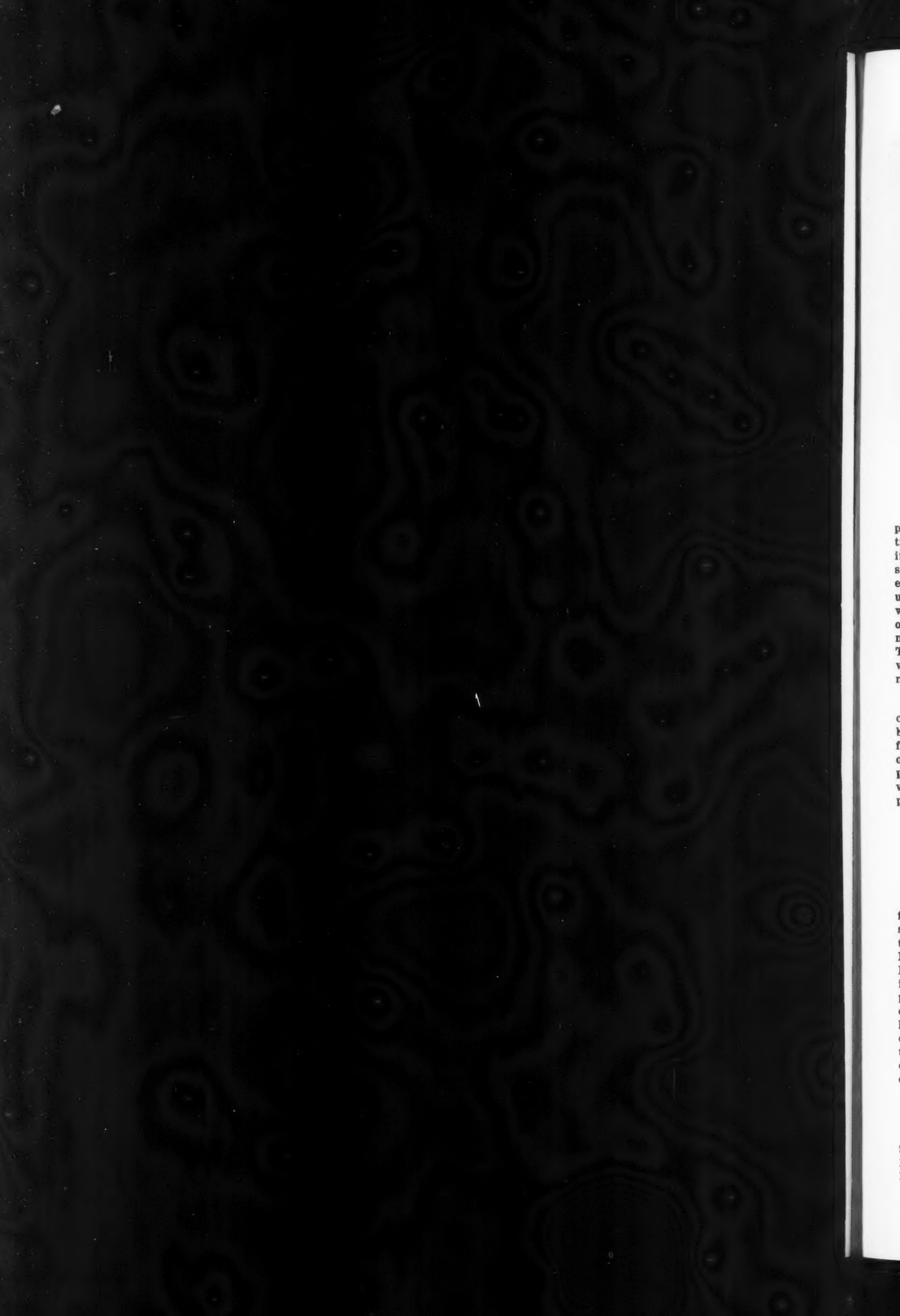
This intricate form is broached complete with tooling designed and built by Detroit Broach Company. Production is 400 pieces per hour and the finish is suitable for final assembly.

Broaching offers great savings on all types of contours, whether intricate or simple. Through broaching, greater production can be maintained with less idle machine time. Surface finish is usually suitable for final assembly. Close tolerances are easily held and all parts produced from a broaching set-up are identical.

Detroit Broach engineers have pioneered many of the advances in contour broaching. Specializing in broaches and broach tooling exclusively, they are thoroughly acquainted with all types of broaching on all broaching machines. Why not have our representative drop in to discuss the broaching of some of your parts? It will be a worthwhile step toward beating today's high cost of manufacturing.

DETROIT *Broach* COMPANY

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DETROIT 12, MICHIGAN



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(Left) P. H. Batten, Who has Resigned as President of the Twin Disc Clutch Co., and (Right) John H. Batten, Who Succeeds Him as President

pany in 1935, following his graduation from Yale University. He worked in the various departments of the shops and in the office, so as to gain experience in all phases of the manufacturing operations. In 1937, he was appointed a member of the board of directors, and in 1940 he was named assistant general manager. Three years later he was appointed vice-president, and in 1945 he was made executive vice-president.

BOWEN GRINDERS, INC., 1607 Crescent Drive, Beloit, Wis., has recently been founded for the manufacture of face grinding machines. The officers of the company are: ALFRED J. BOWEN, president and treasurer; Q. O. BOWEN, vice-president; and E. M. BOWEN, vice-president and secretary.

* * *

Worthington International Training Program

Twenty-five students coming from foreign countries the world over started October 1 on a six months' training course at the Harrison, N. J., works of the Worthington Pump & Machinery Corporation. This international training program is part of an effort being made by the company to create and maintain harmonious trade relations with foreign countries, and is open by invitation to men abroad who have special qualifications along mechanical or engineering lines.

* * *

In 1929, the average hourly rate for steel workers was 65.4 cents. In 1947, it was \$1.513—an increase of 131 per cent.

Coming Events

NOVEMBER 4-5—Fuels and Lubricants Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Mayo Hotel in Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 4-5 — Third Midwest QUALITY CONTROL CONFERENCE of the American Society for Quality Control at the Sherman Hotel in Chicago. Further details can be obtained from Third Midwest Quality Control Conference, P. O. Box 1097, Chicago, Ill.

NOVEMBER 14-17—Annual meeting of the NATIONAL TOOL AND DIE MANUFACTURERS ASSOCIATION at the Hotel Schroeder in Milwaukee, Wis. Executive secretary, George S. Eaton, 1412 Union Commerce Bldg., Cleveland 14, Ohio.

NOVEMBER 18-19—Annual meeting of the NATIONAL FOUNDERS ASSOCIATION at the Sheraton Hotel in Chicago, Ill. For further information, address the Association at 120 S. LaSalle St., Chicago 3.

NOVEMBER 28-DECEMBER 3 — Annual convention of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18.

NOVEMBER 29-DECEMBER 4 — EIGHTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace in New York. Chairman of the advisory committee, I. E. Moulthrop, Grand Central Palace, New York 17, N. Y.

DECEMBER 2-4—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS

ANALYSIS at the Hotel Commodore in New York City. For further information, address the Society at P. O. Box 168, Cambridge 39, Mass.

JANUARY 10-14, 1949—Annual meeting and Engineering Display of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel in Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

JANUARY 10-14, 1949 — MATERIALS HANDLING EXPOSITION at Convention Hall, Philadelphia, Pa. Sponsored jointly by the Management and Materials-Handling Divisions of the American Society of Mechanical Engineers and the Material Handling Institute. Further information can be obtained from Clapp & Poliak, Inc., 350 Fifth Ave., New York 1, N. Y.

FEBRUARY 28-MARCH 4, 1949—Spring meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Edgewater Beach, Chicago, Ill. Further information can be obtained by addressing the Society at 1916 Race St., Philadelphia 3, Pa.

MARCH 3-5, 1949—Fifth annual conference of the American Society of Training Directors at the Hotel Carter, Cleveland, Ohio. Chairman of the Publicity Committee, L. W. Morgan, Care of the Yoder Co., 5500 Walworth, Cleveland, Ohio.

MARCH 8-10, 1949—Passenger Car, Body, and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MARCH 28-30, 1949—Transportation Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Statler Hotel in Cleveland, Ohio. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 11-13, 1949—Aeronautic and Air Transport Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker in New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 25-28, 1949—FOURTH SOUTHERN MACHINERY AND METALS EXPOSITION in the Atlanta Municipal Auditorium, Atlanta, Ga. Michael F. Wiedl, managing director, 267 E. Paces Ferry Road, N.E. Atlanta, Ga.

JUNE 27-JULY 1, 1949—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Chalfonte-Haddon Hall, Atlantic City, N. J. For further information, address the Society at 1916 Race St., Philadelphia 3, Pa.

Obituaries



R. G. Haskins

Raymond Glessner Haskins, president and founder of the R. G. Haskins Co., Chicago, Ill., died on August 17 at the West Suburban Hospital in Oak Park, Ill., aged fifty-nine years. He was born on April 13, 1889, in Chicago and was educated in the schools of that city and at the Culver Military Academy, Culver, Ind., and the University of Michigan, Ann Arbor, Mich. In 1919, he founded the R. G. Haskins Co., manufacturer of flexible-shaft equipment and bottle-capping machines. Mr. Haskins is survived by his wife and a son and daughter.

Kirke R. Wilson

Kirke R. Wilson, hydraulic press manufacturer and nationally known designer and builder of specialized



Kirke R. Wilson

automotive repair and service tools, died in Detroit on September 25 at the age of fifty-nine years. Mr. Wilson made his start in the business world repairing bicycles in one end of an old barn in Arcade, N. Y. Later he became a Ford dealer in that town. In 1913, he went to Buffalo and opened a Ford part and accessory business. His experience in this field pointed out the need for specialized tools and equipment in order to service and repair Ford cars and trucks economically, and led to his invention of a bushing reaming machine for the old Ford Model T planetary transmission.

Mr. Wilson's entry into the hydraulic press manufacturing field was the direct result of building equipment for Ford dealers. To

speed up many pressing operations in connection with regular Ford service, the factory developed a small 35-ton hydraulic arbor press in 1923. From this modest beginning, the business was expanded until today, the company manufactures a line of presses ranging from the small arbor type to 100-ton hydraulic, blanking, stamping, and forming presses.

EUGENE T. SCOTT, former sales manager of Templeton, Kenly & Co., Chicago, Ill., died on September 30 at his home in Hinsdale, Ill., at the age of thirty-five years. Ill health caused his retirement from active duty with the company early in 1948, although he had continued to serve on the board of directors. He is survived by his widow and daughter.

New Books and Publications

POOR'S REGISTER OF DIRECTORS AND EXECUTIVES (1948). 3227 pages, 9 by 11 1/2 inches. Published by Standard & Poor's Corporation, 345 Hudson St., New York 14, N. Y. Price, \$85. Available on a lease basis for \$60.

This comprehensive register of directors and executives serves as a quick national reference guide for locating the officers in leading corporations in the United States and Canada. There are two main sections in the directory. One contains an alphabetical list of the names of the corporations, and gives the names and addresses of the directors and officers, as well as other important executive personnel, such as sales manager, purchasing agent, chief engineer, works manager; number of employees; and principal products. This section covers 19,000 corporations and includes over 1150 pages. The other main section contains an alphabetical list of directors and executives, giving principal business affiliations, business addresses, residence addresses, year and place of birth, and college, class, and fraternal affiliations. There are 93,000 listings in this section, covering 1667 pages.

The other sections of the book include a Classified Index of Corporations, arranged according to industries; a Product Index, comprising an alphabetical list of the products (a new feature of the present edition); an Obituary Section; and a New Name Section. In the Classified Section, 250 groups are included. The New Name Section contains a complete alphabetical list of the individuals whose names appear in the register for the first time. The principal business connection and business address are given here also, so that checking may be accomplished quickly

and easily. The Obituary Section records the deaths of individuals, notices of which have been received during the past year.

The register is of value to sales, advertising, and public relations departments, as well as to advertising agencies. It carries with it a reference and inquiry privilege in a well-known financial laboratory. Whether the directory is leased or bought, the user is provided with periodic supplemental reports which keep the information up to date. The work of keeping the register up to date is carried on throughout the year.

MOLYBDENUM—STEELS, IRONS, ALLOYS.

By R. S. Archer, J. Z. Briggs, and C. M. Loeb, Jr. 391 pages, 6 by 9 inches. Published by the Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y. Distributed without charge to metallurgists and others closely connected with the metallurgical industries.

The varied applications of molybdenum as an alloying element are described in this book, which covers a wide range of materials—from wrought to cast steels and from cast iron to non-ferrous alloys. Emphasis has been placed on the presentation of the fundamentals that engineers, designers, and metallurgists must be guided by in their selection of the most suitable materials for a given application. An attempt has been made to show the fields of similarity and dissimilarity of the various materials and to indicate some of the factors that may affect the choice of the most economical material for a specific part. Considerable recent information is included, not only on the more prominent developments, such as the gas-turbine steels and alloys, but also on the work that has been

Unexcelled Performance
on all metal cutting operations...
RUTHMAN GUSHER
COOLANT PUMPS

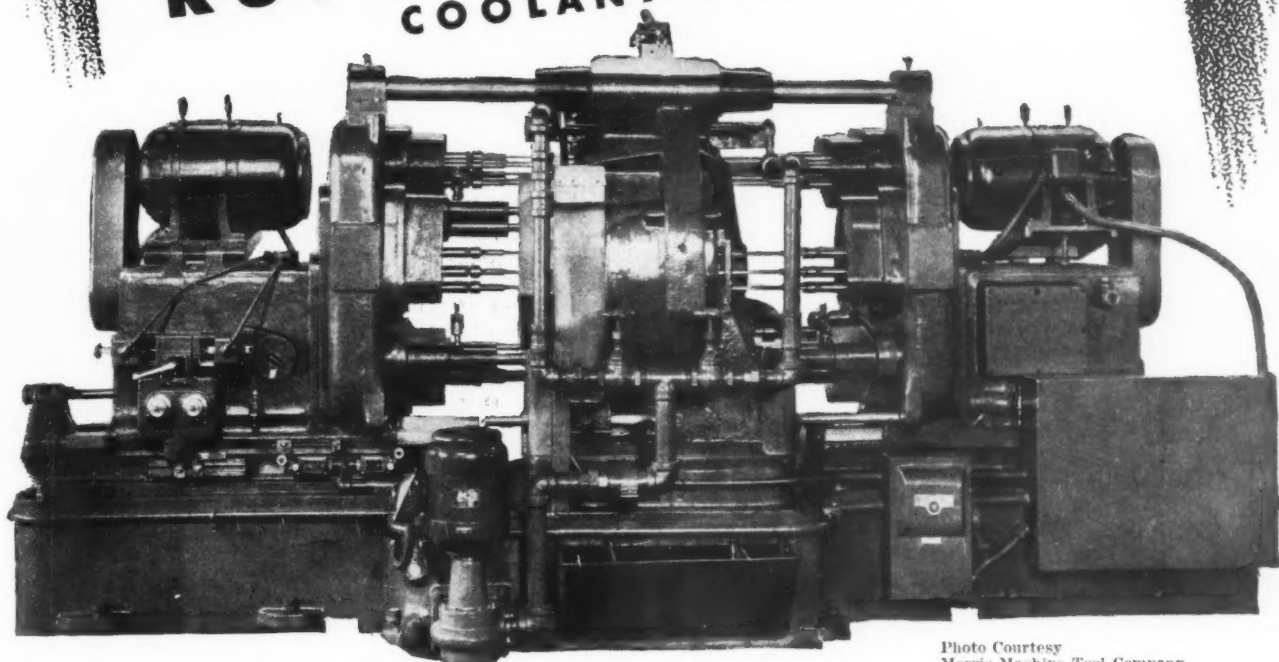
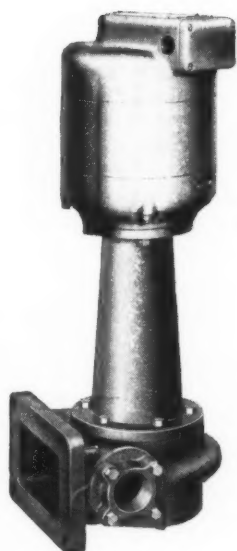


Photo Courtesy
Morris Machine Tool Company



Expertly designed, precision built, Ruthman Gusher Coolant Pumps give year after year of unexcelled performance. Less vibration, fewer parts to wear guarantee a long trouble-free life for Ruthman Gusher Pumps on your metal cutting equipment. Illustrated above is a Morris Two-Way Drilling, Boring, and Reaming Machine with 44 spindles mounted in Cluster Heads; equipped with Model 11024 Short Ruthman Gusher Coolant Pump.

THE RUTHMAN MACHINERY CO.

1807 Reading Road

Cincinnati 2, Ohio



done to clarify the factors influencing the service life of the lower alloy steels.

An idea of the scope of the book will be obtained from the following list of the main section headings: Technical Effects of Molybdenum; Fundamental Effects of Heat-Treatment on Microstructure; Addition of Molybdenum; Wrought Alloy Engineering Steels; Wrought Corrosion-Resistant Steels; Wrought Steels for Elevated-Temperature Service; Tool Steels; Steel Castings; Cast Iron; and Special-Purpose and Non-ferrous Alloys. There are seven appendices which include data on standard compositions of American, British, and French engineering steels, working stresses from the Boiler Code conversion tables, and the physical properties of metallic molybdenum.

DIAMOND TOOL PATENTS—II (Diamond Abrasive Wheels). Edited by P. Grodzinski. 52 pages, 7 1/4 by 9 1/2 inches. Published by the Industrial Diamond Information Bureau, Industrial Distributors (Sales) Ltd., 32-34 Holborn Viaduct, London, EC 1, England. Price 10/.

This pamphlet contains a survey of international patents on diamond abrasive wheels. It is the second of a series of such surveys being issued by the Industrial Diamond Information Bureau. The pamphlet lists and classifies in numerical order about 400 British, American, German, and other patents dealing with this subject. A brief abstract of each patent is included, giving the main features.

PROCESS ENGINEERING. By William H. Schutt. 309 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, \$4.

The step-by-step procedure followed by the process engineer in determining the selling price or direct-labor cost of an article to be manufactured

is described in this book. How to make accurate cost estimates and set up efficient production methods directly from a blueprint are discussed, and detailed information on estimating labor costs and on visualizing manual processes for all kinds of machining operations is included. Formulas for speeds and feeds of power presses and other machines are given. The book covers the selection of the proper material for economical production. Specific examples are given for estimating the cost of producing a number of parts on the power press and by various machining and assembling operations.

DESIGNING FOR ALCOA DIE-CASTINGS. 188 pages, 5 1/2 by 8 1/2 inches. Published by the Aluminum Co. of America, Pittsburgh 19, Pa. Price, \$1.

The rapid growth of the die-casting industry has paralleled the increased use of light metals. Progress has been stimulated by the experience and technical data acquired and the improved practices applied by die-casting engineers and specialists. Much of this accumulated information is of great value to designers and buyers of die-castings, and it is to provide them with the fundamental facts that this book has been prepared. The text outlines the basic principles governing the effective use of light-metal die-castings. Data on the casting process and equipment, alloys, design rules, and brief discussions of machining and finishing die-castings are presented.

ELEMENTARY AND APPLIED WELDING. By Herbert P. Rigsby and Chris H. Groneman. 151 pages, 5 1/2 by 8 1/2 inches. Published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. Price, \$2.

The material presented in this book is especially adapted to the beginning student in both oxy-acetylene and arc

welding. The basic procedures described are illustrated with photographs and sketches, so that the learner is guided from the most simple to the more complicated processes. The descriptive material covers industrial opportunities, commercial methods, tools and equipment, metals, and safety practices. Various specific problems are given, in which the materials, tools, and equipment, as well as step-by-step procedure, are outlined.

* * *

Screw Machine Engineering Scholarships Awarded

Announcement has been made of the award of two \$1500 scholarships for three years of study of screw machine engineering at the Rochester Institute of Technology, Rochester, N. Y. The winners of the scholarships, which were established by the Titan Metal Mfg. Co., Bellefonte, Pa., and the D. A. Stuart Oil Co., Chicago, Ill., are Bruce Watkins and John M. Carney. Young Watkins is employed by the Charles D. Hoyt Co., Inc., Mishawaka, Ind., and his fellow winner by the Western Automatic Machine Screw Co., Elyria, Ohio. Both will continue to work during alternating periods while completing their studies.

This course in screw machine engineering was instituted two years ago by the Rochester Institute of Technology in cooperation with the National Screw Machine Products Association. The purpose of the awards is to aid in the development of new techniques and improve standard methods of screw machine engineering, as well as to help provide better informed technical supervision for the industry. Employees of the member firms of the National Screw Machine Products Association are eligible for the scholarships.



A novel means of demonstrating motors to prospective customers has been devised by the U. S. Electrical Motors, Inc., manufacturers of Varidrive motors. As the average industrial motor, ranging up to 50 H.P., is obviously too heavy to carry about, miniature models, exact as to detail but only a fraction of the actual motor size, have been designed and set in a light traveling case. A plastic cover permits full vision of internal operating parts. The model can be operated on a prospective buyer's desk by plugging into a light socket. Speeds can be changed by turning a control panel.